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WATER SUPPLY ORGANIZATION IN THE CHICAGO REGION

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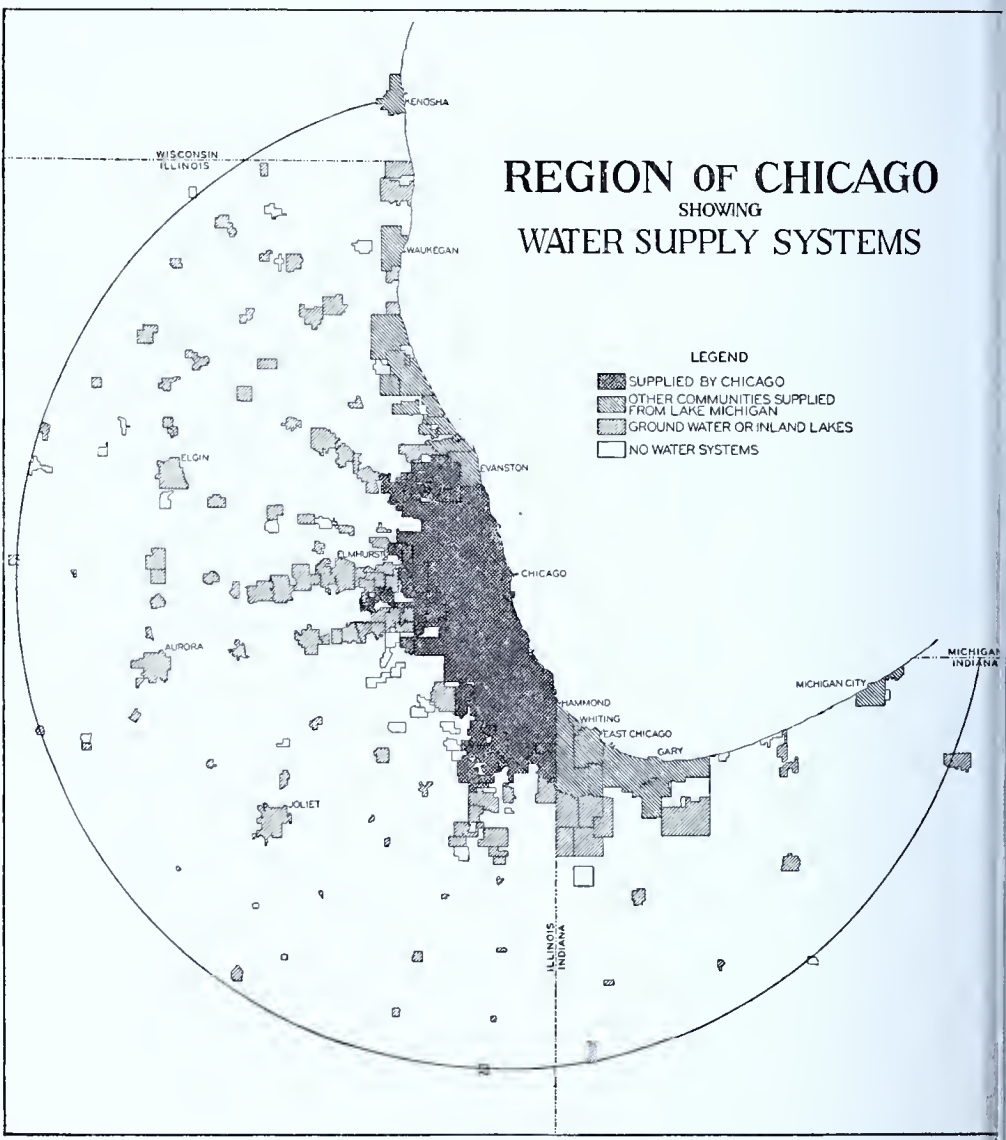
REGION OF CHICAGO
SHOWING
WATER SUPPLY SYSTEMS
LEGEND
SUPPLIED BY CHICAGO
OTHER COMMUNITIES SUPPLIED FROM LAKE MICHIGAN
GROUND WATER OR INLAND LAKES
NO WATER SYSTEMS
KENOSHA
WISCONSIN
ILLINOIS
WAUKEGAN
ELGIN
EVANSTON
ELMHURST
CHICAGO
AURORA
HAMMOND
WHITING
EAST CHICAGO
GARY
MICHIGAN CITY
MICHIGAN
INDIANA
JOLIET
ILLINOIS
INDIANA

The University of Chicago

WATER SUPPLY ORGANIZATION IN THE CHICAGO REGION

A DISSERTATION SUBMITTED TO THE FACULTY OF THE DIVISION OF THE SOCIAL SCIENCES IN CANDIDACY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

DEPARTMENT OF POLITICAL SCIENCE

1934

By

MAX R. WHITE

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1934

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TO

MY MOTHER AND FATHER

PREFACE

While this is primarily a study of the water-supply systems of the Chicago Metropolitan Region, the problems considered here are representative of the governmental problems which are found in many, if not most, of the metropolitan areas in the United States.

The question of how to adapt urban government to the rapidly emerging metropolitan community is one of the most urgent which political scientists must face at the present time. According to the last census, there are 96 metropolitan districts in the United States, each with a minimum population of 100,000 and with a total population of 54,743,645. In all of these metropolitan areas, there is a large number of governments, including a central city and many suburbs and satellites. The problem of what sort of relationship is to be set up among this group of communities is a difficult one, but one which must have an answer. It is hoped that this study offers some small contribution to the solution of this problem.

The supplying of water is a governmental duty which is of considerable significance in the development of an urban community. The absolute necessity of a satisfactory supply of water to the existence of the city is too obvious to require elaboration. But the furnishing of water cannot be accomplished without considerable effort, expense, and planning; and it is here that the governmental organization has an important rôle. Perhaps, in discussing water-supply organization some light will be shed upon the larger problems of governmental organization in metropolitan areas.

This study is one of a series which has been prepared at the University of Chicago on the Chicago Metropolitan Region. In the field of government, surveys of the general problem of metropolitan governmental organization and of the special problems of public-health organization and the judicial system have already been published, and studies of police and the *matériel* problem are in preparation. In other fields, population trends, geography, physiography, and agriculture have already been given attention in published works. This water-supply study fits in with these surveys of the Chicago Area.

I am particularly indebted to the Social Science Research Committee, whose financial assistance made this study possible, and to Professor C. E. Merriam, who inspired and guided my work. It is impossible to mention all of the individuals, engineers, governmental officials, and others who contributed to this study; but I am especially grateful to Mr. John W. Alvord, of Alvord, Burdick, and Howson, consulting engineers, and to Mr. Arthur E. Gorman, engineer of water purification of the city of Chicago, who read the manuscript and offered invaluable suggestions. Finally, I wish to express my thanks to my wife, whose encouragement meant much to this study. I need not add that I alone am responsible for any errors in fact or judgment.

MAX R. WHITE

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CHAPTER I

THE CHICAGO REGION AND ITS WATER SYSTEMS

With an unlimited supply of fresh water at its door, no area in the world is more favorably situated with respect to water supply than the Chicago Region. Lake Michigan is an inexhaustible well from which the people of the Region can pump water with relative facility. Other great urban centers must go long distances and build large and expensive reservoirs and tunnels to obtain abundant quantities of water. New York has tunneled through rock to carry water from the Catskill Mountains 160 miles away. Los Angeles and her sister-cities have joined to transport water 250 miles over arid deserts and rugged mountains from the Colorado River, where it is stored by the Boulder Dam. But the Chicago Region has in its own front yard a great Lake which, with only a modicum of effort, can be made to serve all of the needs of its people.

The responsibility for supplying water from the Lake, however, is divided among 208 governments, 168 water systems, and 1,500 officials, making very difficult the utilization of the exhaustless pool of water to satisfy the requirements of the people in the Region. To explain wherein and why the difficulties have arisen is the main purpose of this study. Before plunging into the work of the water-supply organization it may be well to delimit the Region, to describe its governments, and to set forth its water-supply problems.

I. THE CHICAGO REGION

The Chicago Region has been defined as the area 50 miles in every direction of the intersection of State and Madison streets in Chicago.[1] Among the five million people in this area modern methods of communication have developed a community of soeial and economic interests which pervade most of their daily activities. Persons who dwell in the outlying areas move daily into Chicago to earn their living. The metropolis is a focal point for shoppers, for pleasure-seekers, and for individuals who wish to exploit its eultural advantages. The movement is not entirely in one direction, for persons living in Chicago stream out over broad highways into the open country of the less densely inhabited sections of the Region. From Chicago are distributed the newspapers which the suburbanites read and the goods which they consume.

It is not surprising, then, to learn that governmental problems are expanding beyond the boundaries of the central city to Chicago's satellites, that public health problems, judicial problems, police problems, and many others are taking on a scope which is Regional in character.[2]

The Region is a unity also for the function of supplying

[1] C. E. Merriam, S. D. Parratt, and Albert Lepawsky, *The Government of the Metropolitan Region of Chicago.* While this definition is more inelusive than that adopted by the United States Census Bureau (*Fifteenth Census of the United States* [1930], "Metropolitan Distriets"), it deviates slightly from the area adopted by the Chieago Regional Planning Assoeiation, whieh defined the Region originally by ineluding the whole of eertain eounties within 50 miles from the periphery of the eity. The southwestern tip of Miehigan, whieh is within the 50-mile eirele, is exeluded from the diseussion in this study.

[2] Merriam, Parratt, and Lepawsky, *op. cit.;* Albert Lepawsky, *The Judicial System of Metropolitan Chicago;* Robert F. Steadman, *Public Health Organization in the Chicago Region;* see also forthcoming reports by D. G. Monroe on "Poliee Proteetion in the Metropolitan Region of Chieago" and by C. F. Chute on "The *Matériel* Problem in the Chieago Metropolitan Region."

water, for 53 cities, towns, and villages, containing more than 85 per cent of the population of the Region, already secure water from Lake Michigan (Table I). Thirty-four of these municipalities, with over three-fourths of the population of the Region, are supplied by the city of Chicago alone; and while 16 of the 53 border the Lake, 37 are

TABLE I

SOURCES OF WATER SUPPLY OF THE POPULATION IN COOK COUNTY AND IN THE REGION

	Cook County		Region	
	Population	Percentage	Population	Percentage
Supplied from Lake Michigan	3,789,919	95.2	4,155,700	85.5
Supplied by Chicago	*3,688,882*	*92.6*	*3,688,882*	*75.9*
Supplied from ground-water sources or inland lakes	150,648	3.8	458,987	9.4
Not supplied by public water systems	41,556	1.0	246,063	5.1
Total	3,982,123	100.0	4,860,750	100.00

inland communities which are provided with water by municipalities which border the Lake. Even the 151 cities, towns, and villages which are supplied from wells or inland lakes or do not now have public water supplies are dependent upon the Lake supply, because of the doubtful abundance of these other sources.

II. THE WATER SYSTEMS OF THE REGION

In contrast with the social and economic unity of the Region and the physical unity for the purpose of supplying water is the division of responsibility for public affairs and for providing water. There are more than 1,600 separate and distinct governments in the Metropolitan Area. Be-

sides the city of Chicago, there are 203 other cities, towns, and villages in the Region. In addition to Cook County, there are 14 other counties; and within these 15 counties are 165 townships. There are 978 school districts, 70 park districts, 4 forest preserve districts, 11 sanitary districts, 190 drainage districts, and even 4 mosquito-abatement districts and 1 public health district. Twenty-seven governments operate in the city of Chicago, and 419 in Cook County. And these do not include the state governments of Illinois, Indiana, and Wisconsin and the federal government, whose activities are of no slight importance.[3]

Of these governments, only the cities, towns, and villages are operating public water supplies; but there are, nevertheless, 76 separate water systems in Cook County and 168 in the Region.[4] Ringed around the Chicago water system, which supplies a population of 3,376,438, is a medley of smaller water systems which range in size from Gary, which provides water to 100,426 people, to Forest View, which has only 125 inhabitants. Not all of these systems are publicly owned. Six of them, including Gary, which is the second largest city in the Region, are owned and operated by private companies. Five others purchase their water

[3] Merriam, Parratt, and Lepawsky, *op. cit.*

[4] Cf. Appendix. This figure includes as independent units all communities which purchase water from other communities but distribute it themselves. It excludes a number of small units which do not serve municipalities or supply only small sections of municipalities. Thus, it excludes South Park and Lincoln Park, which have their own pumping stations, and West Park, which maintains the distribution system within the park area. Some other units which are excluded are the one in the village of McCook operated by the owner of the homes in the village; the water supply owned and operated by the subdivider in the unincorporated area of Lisle; the three water works in the village of Midlothian, two of which are operated by subdividers and one by a small group of residents in the village; and the small privately owned system in Villa Park which supplies a few of the citizens.

from private parties but distribute it themselves. Only 1 of these 168 water systems serves more than one municipality; the Home Water Company of Chesterton also provides Porter with water, the combined population of the two towns being 3,036. Even the 33 suburbs which purchase water from Chicago and the 5 communities which purchase water from other municipally owned systems distribute the water.

From the standpoint of the number and variety of officials who are vested with the duty of supplying water, there is still greater confusion. Including 37 municipalities which do not have public water supplies at the present time but which are empowered to instal them and may do so in the future, there are 144 villages, 20 towns, and 60 cities in the Region. In 142 of the 144 villages (all in Illinois), varying in size from Symerton, with 77 inhabitants, to Oak Park, with 63,982, the village boards of 6 members and the village presidents are responsible for providing water. In the villages of Forest Park and Downers Grove there are commissions of 5 members. In the 19 Indiana towns, varying in size from Dune Acres, with a population of 12, to East Gary, with 2,409, authority is exercised by town boards of 3, 4, or 5 members; and in the town of Cicero, of 66,602 inhabitants, by the town president and the town board of 4 trustees and the collector, supervisor, and assessor. In 31 of the 40 cities, which range from McHenry, with 1,354 people, to Chicago, with 3,376,438, there are mayors and councils, the latter varying in size from 6 to 50 members. In 8 cities (all in Illinois) there are commissions of 5 members; and Kenosha, the only Wisconsin municipality, has a city commission of 7 members. In addition, the boards of public works of 3 members in Hammond, Whiting, and La Porte and the water boards of from 3 to 7

members in Glencoe, Waukegan, East Chicago, Michigan City, and Valparaiso have more or less independent control of the water systems. Altogether, there are about 700 officials in Cook County and 1,500 in the Region who divide the responsibility for supplying water.

Even supervision is dispersed among 3 state governments, with capitals at Springfield, Indianapolis, and Madison, far from one another and from the Region, and the federal government. And within these governments, responsibility is not concentrated but is divided among 4 agencies in Illinois, 4 in Indiana, 5 in Wisconsin, and 2 in the federal government.[5]

This disorganization of water-supply authorities might be overlooked if the Region consisted of slowly growing, dispersed, independent communities. But the Region is a single, rapidly growing, dynamic community in which water-supply problems are becoming more pressing and more interrelated.

III. THE WATER-SUPPLY PROBLEMS OF THE REGION

The chief problem confronting the governments, water systems, and officials of the Region is to employ the water resources, of which Lake Michigan is by far the most important, to meet the needs of the people. But this is com-

[5] In Illinois, the Division of Sanitary Engineering of the Department of Public Health, the State Water Survey in the Department of Registration and Education, the State Fire Marshal in the Department of Trade and Commerce, and the Illinois Commerce Commission; in Indiana, the Department of Sanitary Engineering of the State Board of Health, the Division of Geology in the Department of Conservation, the State Fire Marshal Department, and the Public Service Commission; in Wisconsin, the Bureau of Sanitary Engineering of the State Board of Health, the State Hygienic Laboratory of the University of Wisconsin, the Geological and Natural History Survey, the State Fire Marshal, and the Railroad Commission; in the federal government, the United States Public Health Service in the Treasury Department and the Water Resources Branch of the United States Geological Survey.

plicated by the growing demand for more water, better water, and cheaper water which extends throughout the Metropolitan Area unhindered by state and municipal lines.

Not more than 350,000,000 gallons of water were pumped in the Region on the average day in 1900 (Table II). But by 1930, the city of Chicago alone was pumping over 1,000,000,000 gallons, and the consumption of the Region had increased nearly threefold. Gary was an uninhabited sand dune in 1900, but by 1930 it was supplying

TABLE II

AVERAGE DAILY PUMPAGE OF WATER AND POPULATION IN THE CHICAGO REGION, 1900–1930

YEAR	GALLONS (000 OMITTED)					POPULATION
	Chicago	Kenosha	Gary	Evanston	Region*	
1900	342,901	1,552	.....	4,921	350,000	2,202,975
1910	518,579	3,140	672	6,231	550,000	2,886,152
1920	760,118	5,351	4,566	5,786	830,000	3,678,438
1930	1,019,876	5,218	9,614	10,327	1,150,000	4,860,750

* Estimated.

over 9,000,000 gallons of water on the average day. Part of this increase is due to the growth of population in the Region, which has mounted from 2,202,975 to 4,860,750, or 121 per cent; but part of it is the result of the rise in the per capita consumption. In 1900, the per capita consumption of Chicago was 187 gallons per day; by 1930 it had increased to 297. At Elgin, the per capita consumption per day has risen at the rate of about 1 gallon per year.

The development of the modern metropolitan community has resulted in a diversification of the uses of water which not only explains the increase in per capita con-

sumption but also the demand for water of better quality. With urbanization has come the drive for sanitation, bringing with it the invention of the bathtub, the washing machine, the kitchen sink, the sanitary toilet, and numerous other devices which are responsible for a greatly extended utilization of water. The concentration of population has made possible, if not necessary, the construction of sewers and paved streets which are flushed by the use of water, and the development of newer recreational facilities, such as parks, golf courses, lagoons, skating rinks, ornamental fountains, swimming pools, aquariums, and zoölogical gardens, in all of which the employment of water is very large. The development of fireproof buildings has tended to reduce the amount of water necessary for fire protection, but this has been partially offset by the growth of compact built-up areas.

Industrialization has brought the greatest diversification in the uses of water. Cooling and condensing, the preparation of food products, the preparation of chemicals, breweries, laundries, the preparation of leather goods, the manufacture of paper and pulp, wool, silk, and cotton manufactures, and dyeing and finishing textiles—these are only a few of the many purposes for which water is indispensable and is utilized in enormous quantities. The Nash Motor Company alone used 136,000,000 gallons, or over 7 per cent of the 1,878,000,000 gallons of water pumped into the distribution system of Kenosha in 1930.

With these new uses, the people are no longer satisfied with water which merely looks fairly well and doesn't smell too badly. Industry demands water which is free from dissolved mineral substances which are injurious in manufacturing. The manufacturer of food products objects to water which is befouled with chlorophenol. Most

water-consumers do not desire a water supply which is subject to contamination by disease-producing bacteria.

The rise of the metropolitan community has brought also the means for meeting the demand for cheaper water. The concentration of population has complicated the problem of supplying water and required the application of science to its solution; the technical advances in water-works engineering which have come as a result make possible not only better service but also more efficient and economical operation. The concentration of population has also brought large-scale operation, which greatly facilitates the introduction of specialized methods with the concurrent efficiencies and economies.

The best illustration of the improvements in the science of water supply is the standardization which has been adopted. In 1914, the United States Public Health Service of the Treasury Department promulgated a standard for the bacterial content of water used on interstate carriers. In 1925, a new standard was adopted, which applied also to turbidity, taste, color, odor, and mineral quality. This standard has been extended from water supplies for interstate carriers to almost all public supplies. In 1916, the National Board of Fire Underwriters adopted a "Standard Schedule for Grading Cities and Towns of the United States with Reference to Their Fire Defenses and Physical Conditions." A considerable part of this schedule refers to water supplies. In 1921, the National Association of Railway and Utilities Commissioners adopted a uniform classification of accounts for water companies. The New England Water Works Association, in the same year, adopted a uniform classification of accounts for municipal water works. The American Water Works Association has interested itself in more detailed phases of water supply and has

formulated and, in some cases, adopted standard specifications for some of the physical equipment of water works. Representing the application of not only engineering, but chemistry, bacteriology, and accounting as well, to water-supply endeavors, this standardization indicates the growing need for the employment of trained specialists to perform the various activities.

In the Chicago Region is found the concentration of population which makes not only possible but even necessary the adoption of efficient and economical methods. With a unified natural area for supplying water, with Chicago already supplying many of its suburbs, with ready intercommunication, the logical situs for large-scale scientific operation already exists. And the need for efficiency and economy spreads evenly over the Region without regard to villages, towns, cities, water systems, and states. The compactness of the Region lends itself to co-operation, co-ordination, and exchange of experience by which superior standards can expand to all sections; and the unity of the interests of the Region requires that these standards be adopted on a metropolitan scale.

IV. CONCLUSION

In the Chicago Region, the natural area for supplying water, like the social and economic interests of the people, transgresses local political boundaries and assumes a scope which is coterminous with the boundaries of the Metropolitan Area. The growing water demands are not found in isolated sections, but are developing uniformly in the municipalities, large and small, city, town, or village, unhindered by state and parochial lines. But governmental boundaries are closely drawn, unchanged by metropolitan conditions.

Has the disintegrated water-supply organization developed the co-operation necessary in order to utilize the bountiful resources of Lake Michigan to meet the demand of the five million people of the Region for more water, better water, and cheaper water? Do the many small units have uniformly high standards of service, or has the multiplication of jurisdictions resulted in many failures to adopt the best practices? Has the congeries of separate water systems taken advantage of the territorial unity of the Region to co-ordinate their activities? Are the state and federal governments exercising effective supervision over the work of the local governments? In what ways might the present organization be reconstructed to make it better adapted to solve the water-supply problems of the metropolitan community? These are the questions we must ask ourselves as we pass in review the various activities of the water systems.

CHAPTER II

THE ABUNDANCE OF WATER SUPPLIES

When the population of the Chicago Region was small, the various communities were able to obtain abundant supplies of water from sources near at hand. The municipalities which bordered Lake Michigan or inland lakes tapped those sources; and the others drew from the underground water supply, of which there was an abundant quantity. With the development of the metropolitan community, however, the most accessible sources are not always adequate to meet the needs of the people, and the municipalities must resort to sources which are farther away. To determine what communities should have the more remote supplies and which should continue with the nearby sources in such a manner as to meet the needs of all units, to transmit the water from remote sources to the communities to which they have been allocated, and to apportion the expense of providing the water among the people who are served, requires a great amount of co-operation. In the Chicago Region this is very difficult to secure because there are so many governments representing the interests of the people.

I. WATER RESOURCES OF THE REGION

There are several sources of water supply in the Region. Fifty-three municipalities, with a population of 4,155,700, tap Lake Michigan. Two municipalities are supplied by inland lakes. The remaining 114 cities, towns, and villages, with a population of 445,121, pump water from the ground

(Table III). No municipality at the present time has an impounded river supply, although this has been considered as a possible source by some of the communities of the Region.

The Lake Michigan supply is practically inexhaustible. Inland-lake and ground-water supplies are of more doubtful abundance. In one of the two municipalities which draw water from inland lakes, the copiousness of the source is doubted by the water superintendent. The extent to which ground water is adequate to meet present and future

TABLE III

NUMBER OF WATER SYSTEMS AND THEIR SOURCES OF SUPPLY IN COOK COUNTY AND IN THE REGION

	Cook County	Region
Supplied from Lake Michigan	41	53
Supplied by Chicago	*34*	*34*
Supplied from ground-water sources or inland lakes	35	115
Total	76	168

requirements of growing populations evokes some diverse opinions.

The ground-water supply consists of a large underground flow lying at depths varying from 20 to 3,000 feet beneath the ground, which in some places rises to the ground level as a spring or in other places is pumped to the surface in a well.[1] This body of water has been tapped at so many places in certain sections that its level has been drawn down several hundred feet. Notwithstanding this fact, many municipal officials insist that it will be quite plentiful

[1] A brief description of ground-water resources may be found in F. M. Fryxell, *The Physiography of the Region of Chicago*, pp. 49–50.

thirty or forty years in the future. The heads of water departments in the larger cities, leading consulting engineers, and state officials are very doubtful of its abundance or, in most cases, are of a positive opinion that it will not be adequate.[2] In view of the fact that many municipalities have already changed from ground water to Lake Michigan water, that many wells are being abandoned, that wells are being drilled into deeper and deeper strata, that new deep wells are being drilled to replace or supplement old deep wells, that the history of Regional wells is one of decreasing yields and receding water-levels, these engineers insist that it is only a matter of time until many of the communities dependent upon ground water will be without sufficient quantities.[3]

A comparison of the amount of ground water available in the Region with the future needs of the suburban cities and villages gives further evidence that the views of these persons are correct. The most rapidly growing section of the Region is outside the city of Chicago in the area which

[2] From interviews with F. DeBolt, commissioner of public property, Chicago Heights; A. S. Calkins, city engineer, Joliet; John W. Alvord and C. B. Burdick of Alvord, Burdick, and Howson, consulting engineers; Paul Hansen of Pearse, Greeley, and Hansen, consulting engineers; W. D. Gerber, engineer, State Water Survey; G. C. Habermeyer, former engineer, State Water Survey. See articles by R. I. Randolph in *Chicago Daily News*, September 12 and 13, 1923; and W. W. De Berard, "Engineering Problems of the Chicago Region and Their Solution," *Engineering News-Record*, CI (1928), 761–62.

[3] At least 38 deep wells have been abandoned by municipalities since 1915, 11 have been drilled to replace shallow wells, and 33 have been drilled to supplement existing deep wells. While accurate data are not available on most of the wells in the Region, it is estimated that the average recession per year is from 5 to 8 feet (W. D. Gerber, "The Hydrology of Industrial and Municipal Water Supplies in Chicago," *Circular No. 11, Illinois State Water Survey*, p. 9). A private well in the Stock Yards Area in Chicago flowed at the surface in 1889. In 1927, the water-level was 300 feet below the ground surface. From 1907 to 1927, the water-level at Maywood dropped 180 feet (G. C. Habermeyer, "Well Water

is now largely supplied with ground water. While the rate of increase in population for the city between 1920 and 1930 was 25 per cent and for the Region as a whole was 32 per cent, the population of the municipalities supplied with ground water increased 53 per cent in the same decade. If this trend is projected into the future, it indicates a need for water which is much larger than the present supply. It is estimated that 50,000,000 gallons of water per day are pumped from deep wells in Chicago and the suburban area.[4] In 1960 there will be an estimated population of 1,200,000 in the municipalities now supplied by ground water.[5] At a rate of 100 gallons per capita there will be a demand for 120,000,000 gallons of water. In Cook County, 30,000,000 gallons of water are, with difficulty, pumped from deep wells by industries and municipalities on the average day.[6] The estimated 1960 population of municipalities with well supplies of 450,000 will require 45,000,000 gallons of water. It seems almost impossible that the

Recessions in Illinois," *Journal of the American Water Works Association*, XVIII [1927], 700–701). The decline in the yield of wells is illustrated in this table from a report of the State Water Survey on the water supply of Joliet. Yields are in gallons per minute; the depth of the water-level is also given.

	1913		1922		1929	
	Yield (G.M.P.)	Pumping Lift (Feet)	Yield (G.M.P.)	Pumping Lift (Feet)	Yield (G.M.P.)	Pumping Lift (Feet)
Ottawa Street well	700	140	546	246	252	.....
Canal Street well	560	.....	292	289	100	.....
Spruce Street well	400	142	184	477	76	.....
Van Buren Street well	750	240	485	418	125	.....
Des Plaines Street well	450	180	305	278	252	.....
Ruby Street well	.....	.....	532	373	389	.....

[4] Habermeyer, *op. cit.*, p. 699.

[5] All estimates of population in this study are taken from *Forecast of Population in the Region of Chicago* (March, 1931), by the Committee on General Surveys of the Chicago Regional Planning Association.

[6] Habermeyer, *loc. cit.*

ground-water supply will be abundant enough to meet these heavy demands. Because of the difficulty of securing adequate well supplies, many communities have already substituted Lake water for ground water; and sooner or later many more communities will have to change.

II. ALLOCATING THE WATER RESOURCES

The process of changing from ground water to Lake water embodies a division of the water resources. The allocation involves principally the determination of which communities shall have ground water, which shall have Lake water, and the time at which any change shall be made.

There is no organization in the Region which decides these questions at the present time, but the individual water systems determine for themselves to what sources they will have recourse. The existing allocation has been profoundly affected, however, by an act of the Illinois legislature. The statute establishing the Sanitary District of Chicago provides that any city, town, or village in the District supplying Lake Michigan water must supply any other city, town, or village in the District at the limits of the supplying municipality.[7] Municipalities are also authorized to enter into contracts for water supplies, but this power has had little influence on the allocation.

The present allocation, which is the result of the action of the independent communities influenced to a certain extent by the provisions of the Sanitary District law, has not comprehended the interests of all sections of the Region. In the first place, the division of the water resources has been based largely on the principle of proximity. The municipalities near the Lake have Lake supplies, and those

[7] Smith-Hurd, *Revised Statutes of the State of Illinois* (1933), chap. 42, sec. 348.

inland have ground-water supplies. Of the 53 cities, towns, and villages supplied by Lake water, 16 border Lake Michigan, 20 are second-tier communities which get water at the common border from one of the water systems bordering Lake Michigan, and 17 are third-tier communities which obtain water directly from or by mains passing through intervening municipalities. Communities which are farther from the Lake have continued with ground-water resources, although many have suffered acutely from inadequate water supplies.

Secondly, all but two of the inland municipalities which have Lake water are in the Sanitary District of Chicago. While the provisions of the law establishing this District have encouraged many communities to tap the abundant Lake supply, these provisions have not been extended to other areas of the Region. This is true in spite of the fact that some of the most inadequate water supplies are in communities outside the Sanitary District. In Indiana, no inland communities have Lake water. While most of the Indiana cities and towns are small and are adequately supplied by wells or inland lakes, there is at least one, Highland, which has had considerable difficulty with its water supply in the past. Even though it adjoins Hammond, which has a Lake supply, it has continued ineffectual attempts to develop an abundant ground-water supply. In the Illinois section of the Region, Chicago Heights, Joliet, Elmhurst, Villa Park, and Arlington Heights are outside the Sanitary District and cannot benefit from the provisions creating this governmental unit, although there is considerable uncertainty as to the abundance of their water supplies. The existing allocation of the water resources disregards the needs of a large portion of the Region.

Thirdly, municipalities and individuals located near the Lake are appropriating ground-water resources to the disadvantage of inland communities. It is estimated that 15,000,000 gallons of water per day are pumped from wells by individuals and industries in the city of Chicago. Another 15,000,000 gallons are drawn from the ground for municipal and industrial use in Cook County outside Chicago.[8] If Lake water were substituted for ground water, a sufficient supply of the latter would be available to supply a population of 300,000 in the area outside Cook County. The allocation of the water resources in the Region so as to allot an abundant supply at a low cost to all communities would require the cessation of this heavy draft on ground-water supplies.[9]

In the fourth place, the Sanitary District law is cumbersome in operation. The provision requiring the supplying of water at the limits is mandatory, but its efficient action is dependent upon the co-operation of the supplying water systems. To secure compliance with this provision of two of the eight municipalities that supply water at their border, it was necessary for the villages requesting water to resort to court action. South Holland was delayed several months in obtaining water from Dolton because of the latter's dilatory tactics, and finally sought judicial intervention. Blue Island refused to supply Robbins until this small Negro village filed a suit in mandamus. These two cases are particularly significant because they suggest what is likely to occur in the future when more and more communities attempt to secure water from intervening municipalities.

[8] Habermeyer, *loc. cit.*

[9] F. T. Thwaites, "Stratigraphy and Geologic Structure of Northern Illinois with Special Reference to Underground Water Supplies," *Illinois State Geological Survey, Report of Investigations—No. 13*, p. 47.

Finally, because of the lack of any organization in allocation, there is no plan for the assignment of the water resources in the future. In spite of the amount of information that has been gathered on the adequacy or inadequacy of present supplies, no one can say definitely what communities now served by wells should have Lake water, which should continue with ground water, and the date at which changes should be made. There is some uncertainty in the case of every municipality not now supplied with Lake water. Thus Arlington Heights, Des Plaines, Melrose Park, Bellwood, Riverside, Lyons, Brookfield, La Grange, and La Grange Park have had such serious difficulties in securing adequate ground-water supplies in the past few years that it would seem that they should be supplied with Lake water in the immediate future. Joliet, Lemont, Lockport, Chicago Heights, and Lansing are farther from the Lake, but consideration should certainly be given to the possibility of providing them with Lake water. It might be commercially feasible to supply Elmhurst, Villa Park, Western Springs, Hinsdale, Wheaton, Naperville, and even Elgin and Aurora with Lake water within the next thirty years. Engineering plans have been prepared in rough form to supply all of these cities and villages by the city of Chicago and private water companies. But a definite division of the water resources, which would leave only the problem of creating the proper organization to supply the communities which have been assigned Lake water, does not exist.

There has been no organized effort to allocate the water resources in the Region, except for the inclusion of provisions in the law establishing the Sanitary District of Chicago compelling certain municipalities to supply water to others. The existing allocation does not provide for the

needs of all sections of the Region. For the future, there is no plan; and with the present governmental disorganization there appears no prospects of one being prepared.

III. TRANSMITTING THE WATER

The next task after determining what communities should secure Lake water is to transmit the water to them. This is relatively simple for the water works which border the Lake, because they have only to construct a tunnel beneath the Lake or lay a pipe on the bottom and arrange a distribution system to deliver the water. It is much more difficult to convey the water to municipalities which lie inland, since large and expensive mains must be constructed. These transmission mains can be provided most logically and most economically if communities adjacent to water systems bordering the Lake receive the water at the common border and transport it to their neighbors, the latter delivering it to the next tier of municipalities, and so on. In case this is not possible, the next best alternative is for a group of outlying units to combine to lay a transmission main to a water system which secures water directly from the Lake. In the Chicago Region some communities have been able to obtain Lake water only with considerable difficulty, and others have failed altogether because the cooperation which is necessary in the transmission of water is lacking.

Chicago has not always provided mains of sufficient capacity to supply its suburbs at points where they can conveniently take water. Chicago, Evanston, Winnetka, Glencoe, and Highland Park supply directly 29 other communities at their corporation limits.[10] Fifteen, or nearly

[10] Chicago to Berwyn, Blue Island, Broadview, Burnham, Calumet City, Calumet Park, Cicero, Dolton, Elmwood Park, Evergreen Park, Forest Park Harvey, Niles, Niles Center, Morton Grove, Oak Park, Park Ridge, Riverdale,

all, of the communities which are adjacent to Chicago, as well as 9 communities which have laid mains through intervening municipalities, are supplied by Chicago at its border. Some of these satellites, however, have not been able to get adequate quantities, and others have been discouraged completely from obtaining Lake water. Park Ridge suffered serious water shortages for several years before Chicago constructed a main large enough to supply it amply. Tessville was forced to wait until Chicago extended its transmission system to receive all the water it needed. A few years ago, when Des Plaines was suffering from one of its perennial water shortages, the city officials considered evoking the Sanitary District law and securing water from Chicago. The plan was to secure water at Devon and Oriole avenues, a point at which there was no city main. The city of Chicago, however, would not extend its mains to this point. Nor could Des Plaines obtain water from Park Ridge, which lies between Des Plaines and Chicago, since Park Ridge was inadequately supplied by Chicago. Des Plaines still has an inadequate well supply. One of the most accessible points for the village of Brookfield to get water from the city of Chicago in 1931 was Fifty-fifth Street and Harlem Avenue. But a connection at this point would not furnish a sufficient supply because of the small city mains.

One step farther along most of the intervening municipalities construct mains only of sufficient capacity to supply their own people. Nine outlying villages with a combined population of 11,537 secure Lake water from inter-

River Forest, River Grove, Summit, Stickney, Tessville, and Westchester; Evanston to Wilmette; Winnetka to Northfield; Glencoe to Northbrook; Highland Park to Deerfield and Highwood.

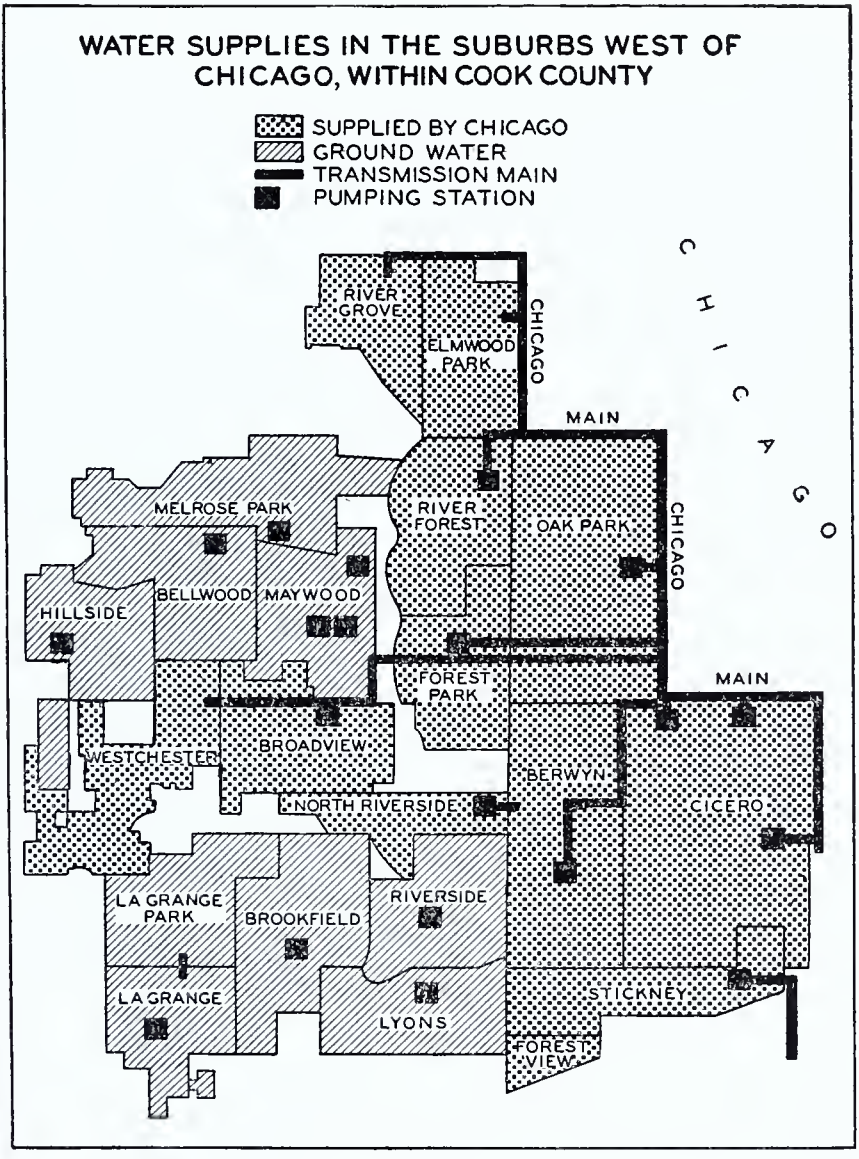
vening water systems,[11] in contrast to nine with a population of 102,668 which have been forced to lay their own transmission mains through intermediary communities.[12] No effort has been made on the part of the second-tier water systems to build their mains a little larger to supply their neighbors, but only those which by chance have some extra capacity furnish water to neighboring cities and villages. Riverside and Lyons, which adjoin Berwyn, have suffered acutely in the past from difficulties of developing abundant well supplies and would almost certainly have taken water from Berwyn if the latter had had larger mains. Melrose Park, which borders River Forest, has an inadequate ground-water supply; but it cannot obtain a Lake supply from the latter village. There are a number of other communities which might be getting Chicago water now if the mains of intervening municipalities were large enough to supply them.

Still farther away from the Lake, the municipalities are not acting together to lay transmission mains to water systems which can supply them from the Lake source. Of the nine cities and villages which have constructed mains through intervening communities, Broadview and Westchester alone have co-operated; while Calumet City, Harvey, Berwyn, Forest Park, River Grove, and Morton Grove have borne the cost separately. It is possible to secure abundant supplies by laying separate mains, if the

[11] North Riverside from Berwyn; Robbins from Blue Island; South Holland from Dolton; Dixmoor, Hazel Crest, Markham, Phoenix, and Posen from Harvey; Forest View from Stickney.

[12] Berwyn along boundary between Cicero and Oak Park, Broadview and Westchester through Oak Park and Forest Park, Calumet City through Burnham, Forest Park through Oak Park, Harvey through Riverdale, Morton Grove through Niles, Niles Center through Tessville, River Grove along boundary of Elmwood Park.

MAP II


WATER SUPPLIES IN THE SUBURBS WEST OF CHICAGO, WITHIN COOK COUNTY
SUPPLIED BY CHICAGO
GROUND WATER
TRANSMISSION MAIN
PUMPING STATION
CHICAGO
RIVER GROVE
ELMWOOD PARK
CHICAGO MAIN
MELROSE PARK
RIVER FOREST
OAK PARK
CHICAGO MAIN
HILLSIDE
BELLWOOD
MAYWOOD
FOREST PARK
MAIN
WESTCHESTER
BROADVIEW
BERWYN
NORTH RIVERSIDE
CICERO
LA GRANGE PARK
BROOKFIELD
RIVERSIDE
LA GRANGE
LYONS
STICKNEY
FOREST VIEW

communities are large or the distances small. But if the reverse is true, it is economically impossible. Riverside, Lyons, Brookfield, La Grange, and La Grange Park—a group of contiguous villages west of Chicago—have all at one time or another considered the metropolis as a source of supply. The two adjacent villages of Riverside and Lyons were faced with water shortages at the same time in 1928 and 1929. Both considered the alternatives of securing water from Chicago or of drilling new wells. Even though they were supplying water to one another in time of need, they did not attempt to formulate a plan to co-operate in laying a main to Chicago. Both decided that it was less expensive to drill new wells than to lay separate mains to Chicago. In 1930, it was Brookfield which was suffering from a water famine. The village officials consulted a leading firm of engineers. It was pointed out by the latter that

> sooner or later the cost of pumping from wells will become prohibitive and the yield reasonably to be expected from new wells will fail to justify their cost. When that time comes Brookfield and its neighboring villages must go to the Lake for an economical and adequate supply of water. It is none too soon to consider means of co-operation with Riverside, and, if possible, other villages, with the object of obtaining lake water as quickly and cheaply as possible. It is doubtful if the Village of Brookfield should consider laying a long water main across adjoining villages to obtain Chicago water for its own use only. From the standpoint of economy co-operation with other villages also in need of water is highly desirable.[13]

Brookfield has as yet (1934) made no effort to obtain the co-operation of Riverside or any other adjacent municipalities. La Grange Park is trying to obtain Chicago water from Westchester, but has not attempted to act with its

[13] From a report by Pearse, Greeley, and Hansen on the water supply of Brookfield, December 4, 1930.

neighbors. La Grange is farther from a Lake supply and has given the inexhaustible source only cursory attention; but this is largely because it has considered only the possibility of individual action.

Bellwood and Melrose Park, adjoining municipalities, have both been unsuccessful in securing completely satisfactory well supplies.[14] While they are about the same distance from Chicago as Broadview and Westchester and their population is over five times that of the latter two villages, little or no consideration has been given to a joint effort to obtain Lake water similar to that of Broadview and Westchester. Joliet and Chicago Heights, the former located 23 miles and the latter 9 miles from Chicago, have had such serious water problems that they have looked longingly toward the Lake. Upon the success in enlisting the co-operation of the municipalities which lie between depends the consummation of a project to supply them with Lake water.

In addition to the immense cost of transmitting water through intervening municipalities, there are difficulties which arise in the securing of easements. While the Illinois law provides that a right-of-way must be given for water-supply mains, there have been at least two cases in which intervening municipalities have delayed their neighbors. Under the law, condemnation proceedings may be conducted and the intervening municipality forced to give the necessary easements. This, however, is a time-consuming and costly process. Much more desirable is an agreement between the two sets of officials. When Forest Park first

[14] Melrose Park installed a new well recently, which was drilled so deeply that the water was saline in character and it was necessary to plug it up a few hundred feet; the capacity of both the new well and the old well have dropped off sharply in the last few years. Bellwood's old well went dry, and it is now purchasing from a private individual who drilled a new well.

approached Oak Park in December, 1930, for a right-of-way to lay its main to Chicago, Oak Park suggested that Forest Park submit a proposition stating how much it was willing to pay.[15] Oak Park finally agreed to permit Forest Park to use its streets at no cost, but this was nearly a year later. Forest Park delayed Broadview and Westchester in some similar fashion three years previously. A serious objection to Brookfield's connection with Chicago at Twenty-ninth Street and Kenton Avenue was that "the acquisition of easements and rights-of-way . . . . would probably be difficult and time-consuming."[16]

Even a private individual may deter a municipality which must obtain easements to lay a transmission main. The city of Zion was preparing to lay a main to Waukegan and had obtained easements from all of the necessary property-owners except one. This individual would not permit the main to pass through his property unless he were allowed to take an unlimited quantity of water and unless other demands were met.[17] While the officials of Zion could have obtained the necessary easements by legal action, they were so discouraged that they abandoned the project.

Two proposals for water systems to include a number of municipalities have been made in recent years. The first of these came from two private water companies which in 1925 applied to the Illinois Commerce Commission for a certificate of convenience and necessity to supply communities in Illinois lying north, west, and south of Chicago. One of these companies, the Greater Chicago Lake Water Company, planned to construct a tunnel from a

[15] *Forest Parker*, December 26, 1930.

[16] From a report by Pearse, Greeley, and Hansen on the water supply of Brookfield, December 4, 1930.

[17] Report from files of Illinois State Water Survey, January 5, 1931.

point in Cicero through Chicago and 4 miles out into Lake Michigan. From the main pumping station in Cicero it intended to transmit water to a large number of cities and villages, of which Arlington Heights, Elgin, Aurora, Joliet, and Chicago Heights constituted the outer eirele. The second of these eompanies, the Munieipal Water Company proposed to construct an intake, filter plant, and pumping station at Wilmette, from whieh it intended to transmit water to a number of municipalities north and west of Chicago. Some of the eommunities to be served were included in both projects. The Illinois Commerce Commission issued a certificate to the Greater Chieago Lake Water Company.[18] There were several reasons for the failure of this venture, but one of the most important was the jealousy and the shortsightedness of the individual municipalities. Both companies attempted to contract with the city and village offieials, but only one munieipality ever agreed to take water. The desire of each community to be the last to sign, for fear that another municipality would make a better deal, held up the companies. Communities which had temporarily provided an adequate supply were unwilling to insure the future adequaey of the supply.

The second proposal for an extensive water system has been made by the city of Chicago. Stimulated by a resolution of the eity council, the bureau of engineering has prepared a plan, including transmission mains and pumping stations, to supply the cities and villages in Cook, Du Page, and parts of Will and Lake (Illinois) counties.[19] This represents the only governmental aetivity in the Region to plan

[18] From testimony before Illinois Commerce Commission, Cases 15407, 15498, 18630, and 20017.

[19] Interview with J. B. Eddy, engineer, Water Pipe Extension Division, Bureau of Engineering, City of Chicago.

a water system on an extended scale. This proposal, however, is entirely in the engineering stage, and suggests no method of securing the co-operation of the outlying municipalities which will be necessary to put it into effect.

Thus, a system of transmission mains has been devised in the Region by which 37 inland municipalities receive water from 5 other municipalities which border the Lake. Deficiencies already appear in the system, for some of these communities are not adequately supplied and others desiring Lake water have been unable to obtain it. The need for more abundant supplies of water is becoming greater in the communities farther and farther from the Lake, but the present organization is ineffective almost in proportion to the distance which it must lay transmission mains. The need for closer integration of the water systems which already appears is certain to become greater in the future.

IV. APPORTIONING THE COSTS OF SUPPLYING WATER

Eleven water systems in the Chicago Region are selling water to other communities, one water system is serving two communities, and two villages have co-operated to lay one main to secure water. Among these communities it has been necessary to devise methods of dividing the costs of supplying the water. Ordinarily this apportionment occurs when the rate is fixed at which one water system sells to another. Unless it is felt that this rate is equitable, the municipalities now purchasing water will be encouraged to develop their own independent systems and inland municipalities now supplied from wells will be disposed to continue these supplies, inadequate as they may be. The providing of abundant quantities of water to inland communities depends, to a considerable extent, upon the success in justly allotting the costs of the water systems.

The general principle followed by the water systems is that the purchasing municipalities shall pay the same rate as the customers within the municipality selling the water. The Sanitary District law stipulates that the cities, towns, and villages which are compelled to supply water under its provisions shall do so "at no greater price or charge than it charges or collects of consumers within its limits for water furnished through meters in like large quantities." In two of the three water systems not under the provisions of this law, the same method of charging for water has been adopted. There are three exceptions to the general principle. Glencoe supplies Northbrook, and Winnetka supplies Northfield, at a rate slightly lower than that which they charge their own customers. The Home Water Company of Chesterton, which is the only water system in the Region in which all activities of supplying water to more than one municipality have been completely unified, charges customers in Chesterton and Porter the same rate.

The wording of the Sanitary District law suggests that the cities, towns, and villages affected by its provisions will have a special rate for large customers. The city of Chicago, however, has only one meter rate, which it charges all customers, including the municipalities which purchase water from it. The result is that Oak Park, for example, which bought over 2,000,000,000 gallons of water from Chicago in 1931 pays 6.8 cents per 1,000 gallons, and the small consumer in Chicago who may consume 70,000 gallons in a year pays the same rate. Berwyn, Dolton, and Stickney also charge their large consumers the same rate as smaller customers. Blue Island, Harvey, and Evanston have a special low rate for their largest consumers from which the municipalities that buy from them benefit as well.

Of much more importance than this failure to provide a

special rate for purchasing municipalities is the fact that the municipality which sells the water fixes the rate. If the latter wishes to make a profit at the expense of the former, if it transfers part of the loss from waste due to its own lethargy to the purchasing municipality which is neither responsible for this waste nor empowered to prevent it, or if it passes the cost of its lack of planning to a neighbor which in its own affairs may be more farsighted, there is nothing to hinder it from doing so. The effect is that the rates accumulate until they become exorbitant in the outlying areas. Chicago sells water to Harvey at 6.8 cents per 1,000 gallons; Harvey in turns sells it to Dixmoor, Hazel Crest, Markham, Phoenix, and Posen at 19 cents per 1,000 gallons; the latter retail it to their own customers at 35 cents, five times as much as Chicago customers only a few miles away must pay for the same water. Dolton buys from Chicago at 6.8 cents and sells to South Holland at 24 cents per 1,000 gallons; South Holland retails at 50 cents.

How it is possible for the municipality providing the water to juggle the rate to its own advantage can be readily illustrated. In the summer of 1930 the small Dutch community of South Holland decided to instal a public water supply. Its officials applied to those of Dolton for the privilege of taking water at the boundary of the two villages. Dolton was charging its own customers 15 cents per 1,000 gallons. The village officials insisted, however, that South Holland pay a greater rate than this because the actual cost of supplying water to South Holland was more than this rate. South Holland filed a suit in mandamus to compel Dolton to comply with the provisions of the Sanitary District law. Dolton thereupon raised the rate to its own consumers, and at the same time to South Holland, to 25

cents per 1,000 gallons, which, the writer was informed, was a rate greater than Dolton's own accountants had indicated as necessary.

Almost bizarre is the sale of water by Chicago at 6.8 cents and the repurchase at 25 cents per 1,000 gallons. It has already been pointed out that Harvey buys water from Chicago at 6.8 cents and sells to Markham at 19 cents. Markham in turn was selling it to Oak Forest infirmary, until a few months ago, at 25 cents per 1,000 gallons. The Oak Forest infirmary is a county institution supported by taxpayers of Cook County, of which the water-consumers in Chicago are a large part. This situation was so glaring that it was corrected recently.

While no inland municipality has discontinued securing Lake water or decided against a Lake supply because of high rates, it is suggested that the rates have about reached their upper limits. It was indicated in one case that the high rate which Berwyn charged North Riverside would make undesirable a connection with Berwyn on the part of Brookfield.

Outside the Sanitary District it is necessary for municipalities wishing to purchase water to contract with another water system. Within the Sanitary District, there have also been some attempts to secure a special low rate by agreement. This process is complicated by certain engineering and legal factors. In order to supply another community, a water works will often have to provide additional facilities. In Illinois, municipalities are not authorized to contract for the sale or purchase of water over a long period of years at a fixed rate. There is some uncertainty as to the exact number of years for which a binding contract may be made, but in one instance an agreement which had run for ten years was held invalid, and in general

one administration cannot bind its successor.[20] The municipality which sells the water is, therefore, compelled to charge a particularly high rate in order to protect itself in case the purchasing municipality decides to secure its water from another source. At the same time there is nothing to prevent a new administration in the vending municipality from raising the contract rate to the disadvantage of the community purchasing the water.

The sale of water by contract has not worked well. Until 1930, when it put its new plant in operation, Highland Park was charging Deerfield and Highwood 12 cents per 1,000 gallons for water. At that time it raised the rate to 20 cents. Deerfield refused to pay the increased rate and, when Highland Park threatened to turn the water off, obtained an injunction preventing Highland Park from disconnecting it. Highwood paid the higher price but protested bitterly. Before 1927, Winnetka furnished water to Glencoe. In order to continue, it would have been necessary for Winnetka to charge a rate high enough to protect itself. Glencoe preferred building its own plant to paying the high rate. The inability of Evanston and Wilmette to agree upon a rate resulted in the latter village voting to construct its own plant in 1931. Zion's final decision not to secure water from Waukegan was due partly to the fear that the latter city might raise its rates at some future date.

The general status of the method of supplying water by contract is well summed up in a statement in a pamphlet which the village board of Wilmette issued during the campaign which preceded the vote on the proposition to construct a water works.

[20] *Trustees of the Illinois Central Hospital for the Insane* v. *The City of Jacksonville,* 61 Ill. App. 199.

Please note that Evanston's proposition provides that at the end of five years an arbitration board will fix the rate for the remaining fifteen years, but that *no basis for computing said rate is provided.* . . . . We feel that we have no assurance our water rate would not be increased at the end of the specified 5-year period. *It would be extremely unwise to enter into such an uncertain contract.*[21]

Even the co-operative arrangement of Broadview and Westchester to lay a transmission main to Chicago did not include a division of the costs for laying the main which was completely satisfactory to both villages. The main was constructed from Chicago through Oak Park and Forest Park to the limits of Broadview—a distance of 4 miles —and through Broadview to the limits of Westchester—a distance of less than 2 miles. The agreement provided that Westchester pay for the 4-mile section of the main and Broadview only for the 2-mile section within its limits. Village officials in Westchester are not pleased with the agreement by which, they claim, Broadview took advantage of its intervening location to foist the greater burden of the cost upon Westchester. The provision in the arrangement by which the water is sold to the two municipalities at the same rate is, however, quite satisfactory.

The provisions of the Sanitary District law and the uncertainties of contracts between governments have made very difficult the equitable apportionment of the costs of supplying water in the Region. The principle set forth in the Sanitary District law has worked as well as it has, largely because of the extremely low rate at which Chicago sells water to its suburbs. Among so many independent water systems it seems doubtful whether a principle for just division can be adopted. Some agency superior to the

[21] *Report and Recommendations of Wilmette Village Board, Wilmette, Illinois, Regarding Water Supply for the Village of Wilmette* (October, 1931), p. 10.

many separate governments in the Region is necessary to apportion the eosts of supplying water.

V. STATE AND FEDERAL ACTIVITIES

The various state agencies might be expected to contribute to the solution of the problems of supplying abundant quantities of water. Their jurisdiction unrestricted by municipal boundaries, they could provide the impulse whieh would lead to the co-operation necessary among the municipalities. In Illinois, where the water needs are most urgent, the state agencies are coneerning themselves chiefly with the improvement of individual supplies. The efforts of the State Water Survey in the Region are directed mainly toward collection and dissemination of information on ground-water resources. It has suggested to a few municipalities that Lake water might be desirable as an alternative source and has voiced the opinion that at some time in the future Lake water will be transported much farther than it is now. It is not the function of this agency to contrive methods by which this can be accomplished. The Division of Geology of the Indiana Department of Conservation also colleets information on water resources. This is only one of its many interests, and its activities are less important in Regional Indiana than those of the Illinois Water Survey in Regional Illinois.

VI. CONCLUSION

The problem of providing abundant quantities of water is Regional in scope, even though the sources are divided and the water systems are diverse. To perform the activities which are necessary to provide copious supplies to the communities which do not have adequate local sources requires the co-operation of many municipalities. This unity of effort is prevented, however, by political boundaries

which cut across the natural area of the problem. There have been several attempts to break down the political isolation, including the provisions of the Sanitary District law, the sale of water by agreement, the joint action of Broadview and Westchester, the projects of private companies, and the plan of the city of Chicago to supply a large portion of the Region. But they have been only moderately successful in the past, and as a basis for united action in the future they appear to be completely inadequate.

That some form of political union is essential seems to be obvious. Only a government which represents the interests of all the communities involved can allocate the water resources, by the very nature of the activity. To provide transmission mains centralization of authority is necessary in order to develop a co-ordinated plan by which one main can serve several communities. Furthermore, a superior government alone can apportion expenses justly.

CHAPTER III

THE QUALITY OF WATER SUPPLIES

It is the task of a water system, in addition to supplying abundant quantities of water, to supply water of pure quality. The demand for water at the present time is not only for inexhaustible supplies but also for supplies which are soft and of low mineral content, or of good mineral quality, which are clean, tasteless, odorless, and colorless, or of good physical quality, and which are safe for cooking and drinking purposes, or of good biological quality.[1] In the Metropolitan Region of Chicago there is considerable difference in the quality of the various water supplies in their natural state. The production of relatively pure water from these sources of varying quality requires the performance of many activities, but these activities are not always effectively carried out because of the multiplication and failure to co-operate of the governments and water systems in the Region.

I. MINERAL QUALITY[2]

The disintegrated water-supply organization has done little to eliminate the disparity among communities in the

[1] This classification is one commonly followed in the water-works profession. Cf. American Water Works Association, *Water Works Practice*, p. 114; "Improvements in Quality of Water Supply," *Public Works*, December, 1930, p. 43.

[2] Illinois and Indiana are among the nine states with the most highly mineralized water in the United States (W. D. Collins, "The Industrial Utility of Public Water Supplies in the United States," *United States Geological Survey, Water-Supply Paper 496*). One of the chief objections to the use of impounded supplies is that they would be very highly mineralized (Alvord, Burdick, and Howson, *Report on the Water Supplies of the City of Elgin* [November, 1931]; State Water Survey, *Report on the Water Resources for a Public Supply for the City of Joliet* [August 8, 1930]).

hardness of the water. Although Lake Michigan water is softer and has a lower mineral content than most of the ground water of the Region, only a few communities have changed from the latter to the former source. Nor has municipal softening been introduced in many communities, despite the fact that its advantages have been amply proved within the Metropolitan Area.

Even with a very liberal classification in which water with less than 100 parts per million mineral content is considered as soft, Lake Michigan water, with 145 parts per million dissolved solids, rates as moderately hard.[3] The ground water of the Region, however, has an average mineral content of 500 parts per million and is saline or excessively hard. It is this very hard water which 35 of the 76 water systems in Cook County and 115 of the 168 water systems in the Region are supplying to their consumers. The real significance of this can best be understood in terms of the effects and the cost of hard water.

The most widely known effect is the difficulty of using soap with hard water.[4] The laboriousness of obtaining a lather, the familiar "high-water mark" in the bathtub, and the slimy curd that is formed when soap comes in contact with the water are the common experiences of householders who have hard water. The undesirable effects of

[3] A. M. Buswell, *The Chemistry of Water and Sewage Treatment*, p. 71, classifies waters as to mineral content as follows:

Class	Total Solids
Soft	Less than 100 p.p.m.
Moderately hard	100–200 p.p.m.
Hard	200–500 p.p.m.
Saline	500 p.p.m. or over

[4] "The hardness of water is a measure of its soap consuming power. This phenomenon is caused by the presence of certain soluble constituents in the water, of which calcium and magnesium are the most important" (*Water Works Practice*, p. 113).

the mineral constituents which produce the hardness go even farther. The forming of scale or sludge in boilers, cooking utensils, and heating coils is due to the presence of calcium and magnesium in the water. The incrustment or corrosion of plumbing, the staining of fixtures, and the clogging of meters can be traced directly to dissolved mineral matter.

Less widely recognized, but of as great importance, are the consequences of the use of hard water in industries. Foaming, corrosion, and the formation of scale occur in steam boilers. The harmful results of highly mineralized water are so great in many industries—such as the manufacture of chemicals, druggists' preparations, patent medicines and compounds, and perfumery and cosmetics; the preparation of leather; wool, silk, and cotton manufacturing; dyeing; and the preparation of paper and wood pulp—that they tend to avoid locations where the water is hard.[5]

What the cost of hard water is to the communities in the Region is not easy to calculate. But when the extra cost of soap is added to the expense of cisterns and double plumbing systems, the harmful effects on fabrics, heat losses in hot-water heaters and boilers, the additional expenditures for operating steam boiler plants, and the loss from the failure to attract industries the total must be large. Many individuals instal rain-water cisterns or their own private softeners. The annual cost of a cistern, covering interest, depreciation, and maintenance, is about $30; the cost of a zeolite softener is about $36 per year.[6] This is considerably more than the ordinary householder will pay for the water. The railroads estimate that the losses from hard water, as

[5] W. D. Collins, "Relations between Quality of Water and Industrial Development in the United States," *United States Geological Survey, Water-Supply Paper 559.*

[6] Alvord, Burdick, and Howson, *op. cit.*

compared with soft water, vary from $400 to $4,000 per locomotive annually.[7]

Some of the best data available is on the cost of soap. A very careful survey was conducted to compare the amount of soap consumed in Chicago Heights with that in another city which had much softer water. It was calculated that the cost of soap in Chicago Heights because of the hard water was $82,000 annually, or $3.67 per capita.[8] The total expenses of the water department were only $100,000 in 1928. It is reported that in Western Springs the sales by one merchant of a commercial product for softening water in the home fell from 180 to 14 cans from the last week before, to the first week after, softening was installed by the village.

When the effects of the hard ground water are so harmful and the cost so great, a deranged water-supply organization which prevents the people from securing the much softer Lake water is an obvious incumbrance. Only 12 of the 53 water systems which are supplied from the Lake have actually changed from underground sources, although it would be very desirable for many others to make the substitution in order to obtain the less highly mineralized water.[9] The difficulties which the municipalities encounter in attempting to extend Lake water have already been discussed. It can only be pointed out here that if the economies from soft water were added to the advantages of the inexhaustible source, it would be practical to transmit

[7] *Water Works Practice*, p. 251.

[8] W. W. Hudson and A. M. Buswell, "Soap Consumption and Water Quality," *Journal of the American Water Works Association*, XXIV (1932), 859–66.

[9] There is a further advantage of Lake Michigan water: it has a smaller proportion of non-carbonate hardness than most of the ground water. Except in the consumption of soap, non-carbonate hardness is generally more detrimental than carbonate hardness.

water from the Lake much farther than for the purpose of providing an abundant supply alone. The ineffectiveness of the present Regional water-supply organization in supplying inland municipalities from the Lake is exaggerated by the need for soft water.

Isolated water systems also present almost insurmountable obstacles to the extension of municipal softening, the alternative to the supplying of Lake water.[10] It is generally conceded that the savings in soap alone will pay for the expense of municipal softening and that it is much less costly for the municipality to soften the water than for individual consumers to instal softeners or cisterns.[11] These benefits from the treatment of hard water, as well as other advantages, have been definitely established in Hinsdale, Western Springs, Zion, and La Porte, where municipal softening has been installed. Yet municipal boundaries have acted as effective barriers to the expansion of this form of treatment to other communities in the Region. The knowledge of the engineers and chemists and the experience with softened water have not penetrated these politically detached units.[12] Even if the municipal officials are cognizant of the value of public treatment, they will not risk their political lives to promote a process which will

[10] Water is ordinarily softened during use by various soap preparations; even boiling will precipitate many of the mineral constituents. In softening before use, lime and soda ash are added to the water, precipitating the impurities as a sludge, which is filtered from the water. In the home, the zeolite system is probably more widely employed (Buswell, *op. cit.*, p. 110). Municipal softening may give a "flat" taste to the water to those unaccustomed to it, which is not noticed, however, by persons who use it regularly.

[11] *Water Works Practice*, p. 251; A. M. Buswell, *op. cit.*, p. 81.

[12] A few years ago the Gillette Razor Co., in one of its advertisements, selected Maywood, Illinois, as its example of a municipality with hard water to contrast with another city with soft water (*Saturday Evening Post*, October 13, 1928). The village officials of Maywood were quite disturbed by the advertisement.

necessitate large outlays for the plant, as long as it is considered a luxury and not an economy by their constituents. A recent report by consulting engineers on the water system at Elgin estimated the cost of improvements with and without softening. At an additional cost of less than 5 cents per 1,000 gallons, or about 28 per cent, the total cost of softening, including the financing of construction (bonds and interest) and operation, could be met.[13] But the extra expense for outlays would have been $190,000, and the city commission refused to instal the plant.

When the state agencies are interested in the problems of hard water, they have contributed little to their solution. The Illinois State Water Survey, the Indiana Department of Sanitary Engineering, and the Hygienic Laboratory of Wisconsin make analyses of water. The Indiana officials have done little more than collect the information. The Illinois Water Survey has published the analyses and has indicated in its publications the amount and cost of chemicals necessary to soften the water.[14] There are three objections to the work of the state agencies. First, such efforts as are being made to improve the mineral quality of water supplies are exerted almost entirely in the Illinois section of the Region. Second, the State Water Survey has had little success in stimulating water-softening, for only three municipalities in the Illinois section of the Region treat their water supplies. Third, almost nothing is being done to encourage communities with hard water to substitute Lake water; in fact, the energy used to promote softening merely draws attention away from the logical solution of the hard-water problem.

[13] Alvord, Burdick, and Howson, *op. cit.*

[14] Illinois State Water Survey, *Chemical and Biological Survey of the Water of Illinois*, Bulletins No. 7 (1908) and 16 (1920).

II. PHYSICAL QUALITY

Nor are the disorganized water systems any more successful in reducing the differences between communities in the physical quality of the water. While most of the municipalities with ground water and 16 of those with filtered Lake water do not suffer from turbidity and disagreeable tastes and odors, 37 communities containing 3,880,603 people, or 80 per cent of the population in the Region, are served with unfiltered water which is at times below standard. The thirty-three suburbs which are supplied by Chicago are among this group, since they are dependent largely upon Chicago for the quality of their water and Chicago has not introduced filtration.

Lake Michigan water, which is superior to underground supplies in mineral quality, is not nearly so attractive in its untreated state from the standpoint of physical quality. With the exception of an occasional supply in which the mineral content is so great that it is apparent to the taste or in which there is a sulphur odor, ground water is free from physical characteristics which detract from its purity. But winds which sweep across the Lake, stirring up the bottom, make the water turbid; and communities discharge their sewage and industries their wastes into the water, creating disagreeable tastes and odors. The physical quality of the water may be improved by placing the intakes far from shore, but in the Region it is not economical to place them far enough out in the Lake to reduce the turbidity, taste, and odor, to the point where they will be inoffensive.[15] Filtration is the most effective way of assuring a water that is attractive.

Eleven water systems, of which Evanston is the largest,

[15] L. D. Gayton, "Filtration of Chicago's Water Supply," *Journal of the Western Society of Engineers*, XXXV (1930), 343.

are filtering their water and supplying 5 other water systems. The combined population of the 16 municipalities is, however, only 275,097. Chicago, Gary, Hammond, and Michigan City are providing unfiltered water to their consumers; and Chicago is selling water to 33 other communities. Among the water systems which do not treat their water in this way are the 5 largest in the Region.[16]

The extent to which this unfiltered water is offensive is greater than is commonly realized. According to the United States Treasury Department standards, an acceptable drinking water has a turbidity not exceeding 10 parts per million and which is, in general, less than 5 parts per million. The water of the city of Chicago averaged 12.5 parts per million in the seven years from 1924 to 1930. It was over 10 parts per million 33.6 per cent of the time and did have as high as 185 parts per million. Tastes and odors which were disagreeable enough to cause complaint were in the Chicago water supply on 60 days in 1930, or 16.5 per cent of the year.[17] At Hammond the people drink the worst appearing, tasting, and smelling water in the Region. At Gary and Michigan City the water is more turbid than at Chicago, though it probably is more desirable from the point of view of taste and odor.[18]

It is estimated that, because of the obnoxious physical quality of the Lake water, $5,000,000 is spent yearly for bottled water for drinking purposes in the city of Chicago. In addition, $1,000,000 is spent for the maintenance and operation of private filters.

[16] Hammond and Michigan City have recently received grants and loans from the Federal Emergency Public Works Administration to construct filtration plants.

[17] City of Chicago, *Fifty-fifth Annual Report of the Department of Public Works* (1930), pp. 106, 124.

[18] See note 16.

A number of manufacturing plants, mostly those engaged in the preparation of beverages and food products, have at various times sustained losses due to spoilage of produets, and suspension of operation during periods when the publie water supply had objeetionable qualities.

Armour and Company made a claim of $33,852.23 against the eity for losses during the months of Deeember, 1927, and January, 1928, caused by ehlorophenol eompounds in the water, which spoiled a large amount of butterine, oleo oils, and sweet-pickle liquor.

The total annual cost of filtering the water which Chicago consumes would not be greatly in excess of the $6,000,000 spent for bottled water and for private filtration.[19]

The filtration problem in Chicago is an old one, for it was suggested that this form of treatment be used as early as 1863.[20] The city engineer has constantly recommended the filtration of the water supply in recent years. In 1930, an advisory referendum on the proposition "Shall the city council pass an ordinance providing for filtration?" received a large favorable majority. No such ordinance has yet been passed. Filtration has been delayed by the construction of tunnels far out into the Lake, by the improvement of the quality of the water in the early years through the construction of intercepting sewers to turn the sewage from the immediate vicinity of the water intakes, and by the diversion of the sewage from the Lake by the Sanitary Canal. In recent years it has been retarded by the excessive consumption of water.[21] As long as Chicago has to

[19] H. H. Gerstein, *Investigotion of the Extent of Post-Treotment of Chicago's Woter Supply by Woter Consumers, Report to the City Engineer.*

[20] *Second Annual Report of the Boord of Public Works to the Common Council of the City of Chicogo* (1863), pp. 50–51.

[21] M. B. Reynolds and A. E. Gorman, "Progress toward Filtration in Chicago," *Journol of the Americon Woter Works Association,* XXIV (1932), 966–67.

pump the enormous amount of water which is wasted, the cost of constructing the plant and installing the equipment for filtration is almost prohibitive. The bureau of engineering has for many years recommended pitometer surveys, universal metering, and house-to-house surveys to stop this inordinate waste; but it has not been given the necessary appropriations or authority by the city council to carry out this program. This neglect on the part of Chicago's lawmakers has delayed filtration of the water of the people of not only Chicago but of many of its suburbs as well.[22]

From the Regional point of view, Chicago's inertness is significant because the 33 communities which receive water from it are also supplied water whose physical quality is objectionable. While these communities are dependent upon Chicago for the quality of their water, Chicago has not co-operated to provide them a supply which meets modern standards of attractiveness. Other municipalities which would like to get Lake water from Chicago have been deterred because of the quality of the water they know they will get.

III. BIOLOGICAL QUALITY

Perhaps more important is the maintenance of the safety of the water supply, which is the oldest activity of water works relating to quality. Since it was discovered that certain diseases are water-borne, there has been an increasing effort to improve the biological quality. Old as the activity is, however, constant vigilance is necessary if the water is

[22] The city of Chicago has recently applied to the Federal Emergency Public Works Administration for a grant and loan of $22,400,000 to pay for meters and a filtration plant to serve a considerable portion of the South Side of Chicago. So far, the objection of certain residents of the South Side to the location of the plant has, among other reasons, prevented any definite action.

safeguarded properly. There have been four serious outbreaks of water-borne diseases in the Region within the past ten years. A typhoid outbreak in Chicago in 1923 was responsible for 150 cases and 15 deaths. At Hammond in 1924 there was an outbreak of 21 cases of typhoid. Four hundred cases of dysentery in Yorkville in 1928 constituted a third outbreak. The fourth outbreak occurred at Riverside in 1929 and resulted in 1,000 cases of dysentery.[23] The latest reports of the Indiana and Illinois bureaus of sanitary engineering list 14 municipalities as having water supplies of doubtful safety.[24]

While the primary responsibility for safeguarding the water supplies of the Region rests on the local governments, a good opportunity for a comparison of the potentialities of central supervision by the federal and the state governments presents itself because the federal government is more active in this function than in any other function relating to water supplies. The United States Public Health Service has established standards for the quality of drinking water and has required interstate carriers to maintain these standards.[25] It also holds annual conferences of state sanitary engineers, who are thereby enabled to discuss their common problems and determine standards of sanitary engineering practice. This supervision by the Public Health Service has been of considerable importance, for it has stimulated the state officials, as well as local water-works people, to improve the biological quality of the water supplies. The Public Health Service has not

[23] Abel Wolman and A. E. Gorman, "The Significance of Waterborne Typhoid Fever Outbreaks, 1920–30," *Journal of the American Water Works Association*, XXIII (1931), 178, 180, 183.

[24] *Indiana Year Book* (1931), p. 255; and information furnished by the courtesy of the Illinois Division of Sanitary Engineering.

[25] R. D. Leigh, *Federal Health Administration in the United States*, pp. 331–35.

directly assumed the task of examining the local water supplies to determine whether they meet the national standard, but the state officials do this work for them. As a result, the state agencies have been encouraged to initiate a number of new activities, necessary to the certification of water supplies for common carriers, which have been extended to all water supplies. Since interstate carriers obtain most of their drinking water from municipal supplies, the local water systems are impelled to take the essential steps to insure a safe supply. The federal agency, because its authority is unrestricted by boundaries of political subdivisions, has promoted uniform standards of efficient practice throughout the Region, which the separate states or the separate municipalities could not have achieved by their own efforts.

The state bureaus of sanitary engineering are making bacteriological analyses of water supplies, inspecting and examining water works, reviewing plans for water works, regulating cross-connections, encouraging chlorination, and issuing orders to municipalities with unsafe supplies. The state governments have been responsible for much of the improvement that has occurred in the safety of water supplies; but their efforts have been seriously hampered by state boundaries, and they have not always given adequate attention to special Regional problems.

By having jurisdiction over a large number of communities they have been able to extend to all of the water systems the standards which would have been attained otherwise by only a few. The small independent water systems do not have the facilities to make water analyses, but the state agencies can provide the bacteriologists who are necessary to perform this work and who can do it at a relatively low cost. The small municipalities cannot afford

to engage engineers with the ability to guard against all possible sources of contamination. The state agencies review every plan and specification for new water works and for extensive improvements in existing supplies, and indicate unsafe features. The separate water works will permit cross-connections between the public supply and private supplies which may result in contamination of the public by the private supplies. But the state authorities forbid these or require such protection as will prevent the mingling of the two sources. The municipal officials will blunder along with an unsafe supply until the state agency suggests that they chlorinate or forecs them to make necessary changes.

State supervision spreads over local water systems unmindful of political boundaries until state lines are encountered, where standards suddenly change. State boundaries are no barriers to water-borne diseases, for typhoid carriers move from Illinois to Indiana and from Illinois to Wisconsin without much difficulty; but these arbitrary lines do affect the nature of state surveillance. The two activities in which these different standards are best exemplified are analyzing water and regulating cross-connections. The bacteriological examination is the most important step preliminary to corrective action, and to be effective it should be made often. The Illinois Division of Sanitary Engineering analyzes samples as they are sent in and collects samples on its own initiative. It has no regular sampling schedule. As a result, most water supplies are analyzed twice a year, but some are examined at longer and others at shorter intervals. The Department of Sanitary Engineering of Indiana requires samples weekly from 60 per cent of the municipal supplies and monthly from 35 per

cent.[26] The branch of the State Hygienic Laboratory of Wisconsin at Kenosha analyzes one sample weekly from the Kenosha water supply. Indiana and Wisconsin have provided by regulations for the elimination or safeguarding of cross-connections.[27] They are forbidden unless very carefully arranged protective devices are installed, and in the latter case frequent inspections with reports to the state authorities are required. Illinois has not forbidden them, and spasmodic inspections are the only protective measures taken by the state agency.

Probably of more significance is the fact that in some instances the state governments simply ignore the needs of the Region. While Indiana granted the Sanitary Engineering Department the power to require that water supplies be made of safe quality in 1919, the Illinois Division had only advisory, and not supervisory, power until 1931.

> All four water-borne epidemics that occurred in the State during the calendar year 1925 . . . . could have been prevented if the warnings of the Division of Sanitary Engineering had been followed or if the department had had authority to order that changes or improvements to the supplies be made.[28]

Steadman's comment on this situation is lucid and to the point:

> This lack of centralized authority is much less important in a farming region, where local affairs are less closely related to neighboring communities, but it is of intense importance in a densely inhabited area cut up into numerous autonomous political units. It is simply another case where the rural-minded legislature fails to comprehend the problems of the metropolitan area.[29]

[26] *Indiana Year Book* (1931), p. 254.

[27] Indiana State Board of Health, Department of Sanitary Engineering, *Rules of the Indiana State Board of Health*, November, 1931, Rule SE9; State Board of Health, Bureau of Sanitary Engineering, *Wisconsin Waterworks, Sewerage and Refuse Disposal Code*, 1929, Section 18.

[28] Illinois Department of Public Health, *Ninth Annual Report*, p. 40.

[29] *Public Health Organization in the Chicago Region*, p. 214.

Another example of this neglect of Regional problems on the part of the states is the concentration of attention downstate on the part of the Illinois Division. Of 128 inspections of water supplies in Illinois in 1930–31, only 18 were in the Region; and of 30 conferences regarding water supplies, only 3 were in the Region.[30] This was true in spite of the fact that a majority of the population of Illinois, as well as the more critical health problems, are found in the Chicago Region.

After all, however, direct responsibility for maintaining the safety of the water supplies rests on the local water systems. The activities which they perform include analyzing of water, placing of intakes far from shore, inspecting the distribution system for possible contamination, chlorinating, and filtering. Another activity, preventing pollution of the water supplies, is discussed in the next chapter. All municipalities are not doing all these things, however; nor are they all performing them equally well.

Only a few of the water systems in the Region are making their own bacteriological analyses. Chicago tested 29,588 samples in 1930, or an average of 81 per day. Kenosha examines about 10 samples per day; Gary, 7; Waukegan, 7; Evanston, 6; East Chicago, 4; Glencoe, 3; and 10 other communities, 1 a day or less. The remaining 151 water systems are dependent upon the state agencies to check on the quality of their water. Here is an activity in which the size of the community is a very important factor. Only the larger cities are able to maintain a staff which is capable of carrying on this work.

The distance which the intakes are offshore is also related to the size of the water system. Chicago's six cribs

[30] Illinois Department of Public Health, *Thirteenth Annual Report* (1929–30), pp. 51–52.

are an average distance of 14,432 feet from shore. East Chicago has recently constructed a 10,000-foot tunnel to get beyond the sewage and industrial wastes which are dumped into its water supply. Gary's intake is 7,920 feet from shore; and Evanston's, 5,600 feet. The intakes of the other municipalities are not so far out.

The inspection of the distribution system for possible sources of contamination is an important activity which has received little attention in the Region. It has already been pointed out that the bureaus of sanitary engineering of Indiana and Wisconsin have stringent regulations with regard to cross-connections between public and private water supplies. While the local officials will take the necessary action to see that they are eliminated or safeguarded if they are discovered, they do not make many serious attempts to find them. An official in one of the larger cities who admitted that no routine inspections are made of cross-connections probably indicated the general practice with considerable accuracy. Chicago is more active in checking the distribution system than any of the other communities. It has been particularly solicitous in eliminating another type of cross-connection, which consists of a connection of the public supply at the bottom of, or below the overflow line of, water containers used in manufacturing so that polluted water or liquids can be forced back into the public water supply.[31] It has been inspecting business premises for this type of cross-connection for years, but as late as 1930 it found almost four thousand of them. In spite of their great potential danger, no other municipality reports inspecting for them.

While Chicago outdistances its suburbs in most of its activities to safeguard the water supply, in what is prob-

[31] City of Chicago, *op. cit.*, pp. 156–57.

ably the most important of all, filtration, it lags far behind many of its small neighbors. Chicago, Gary, Hammond, and Michigan City do not filter, and by this failure place a burden upon protection by chlorination that is exorbitant. According to its own report,

> with the increasing trend of pollution by sewage and industrial wastes, Chicago is rapidly approaching a point where chlorination alone will not produce a safe water unless excessive amounts of chlorine are used.[32]

From the Regional point of view, Chicago's failure to filter is significant because it involves the safety of the water supplies of the 33 suburbs it now supplies, as well as other suburbs for which it is the future source. Under the present Regional organization, Chicago can continue to serve unfiltered water without paying heed to the requirements of its satellites.[33]

The final line of defense against contamination is chlorination. Every water system supplying water directly from the Lake employs this method of treatment either alone or with filtration. Two municipalities which are purchasing Lake water put in additional chlorine. At least 10 communities with well supplies chlorinate now or have at some time done so. Among those which treat their water in this manner regularly are Elgin, La Porte, Joliet, Riverside, Naperville, Lemont, and Momence. Aurora, Geneva, and Dyer have added chlorine to the water from time to time. A number of municipalities the water supplies of which are listed as doubtful, however, do not chlorinate.

Chicago has the most elaborate system of chlorination control in the Region.[34] Duplicate equipment, full-time chlorine operators who are on the job twenty-four hours

[32] *Ibid.*, p. 110.

[33] See notes 16 and 22.

[34] H. H. Gerstein, "Efficiency of Chlorination at Chicago," *Journal of the American Water Works Association*, XXIII (1931), 54–56.

in the day, hourly tests for residual chlorine, and studies of meteorological conditions are some of the features. No other water system has a full-time chlorine operator. Of Hammond, Michigan City, and Gary, which, like Chicago, do not filter, the first two have only part-time chemists. Tests for residual chlorine are made, however, hourly at Hammond and Gary and twice an hour at Michigan City. None of these three cities has attempted to observe meteorological conditions. In the municipalities which filter, the tests for residual chlorine are made at intervals varying from once an hour at Glencoe to once a day at Highland Park.

Two additional governments have in the past contributed to the maintenance of the safety of the water supplies. In the period 1925–29 there was a Cook County Department of Health with a Division of Sanitary Engineering. Most of the work of the sanitary engineer was with private supplies, but he occasionally analyzed and inspected public supplies. From 1924 until April, 1932, the Sanitary District of Chicago collected samples from the water supplies of cities and villages located along Lake Michigan in Indiana and Illinois and analyzed them. On at least two occasions it analyzed ground-water supplies within the District. The maintenance of the first of these two agencies indicated in itself that the state and local governments were not proficient in their work.

The accomplishments of the Sanitary District of Chicago exemplify what may be attained by an agency with headquarters at the center of the Region and the interest of which is concentrated on Regional problems. When the Sanitary District of Chicago began collecting three samples of water a day on six days of the week from all of the Lake shore municipalities from Gary to Waukegan, except

Chicago and Kenilworth, these water systems did not analyze their own supplies, and the supplies were subject to frequent contamination. When the Sanitary District discontinued its work, all but two were prepared to take it over and the water supplies were all safe. By disclosing conditions as they existed, by advising water-works officials on improvements to be made, and by assisting them at times, the Sanitary District was able to solve a problem that the state departments and the local governments were unable to solve. The expense of collecting and testing the samples was borne by the District, illustrating the tendency of the suburbs to lean upon their larger neighbor. Since the Sanitary District stopped doing this, Lake Forest has been without this safeguard, and Highland Park was forced to initiate water analyses.

IV. CONCLUSION

As in the task of supplying water in abundant quantities, in discharging the duty of providing water which is of good quality no single city, no single town, no single village, and no single water system stands alone. State supervision and national advice cut across the problem of supplying pure water, but essentially it is Regional as well as local. The interdependence of the communities appears in every activity to improve the quality, calling for integrated effort and action. But the congeries of small water systems stand in the way, isolating, localizing, and dissipating the exertions of the individual municipalities.

Regional control is vital in this function, which not only affects the pocketbooks and the senses of the five million people in the Region but also the health of this larger community. A unified government can carry soft Lake water across political boundaries into communities which now

have hard water. Or, if it is less expensive to do so, it can introduce the benefits of municipally softened water into all communities with hard water. It can ignore municipal lines and extend filtration to large sections of the Region where local selfishness has prevented it in the past. Finally, the enlargement of the water system will make possible the adoption of improved methods of safeguarding the water supply which are denied to them now because of their small size.

CHAPTER IV

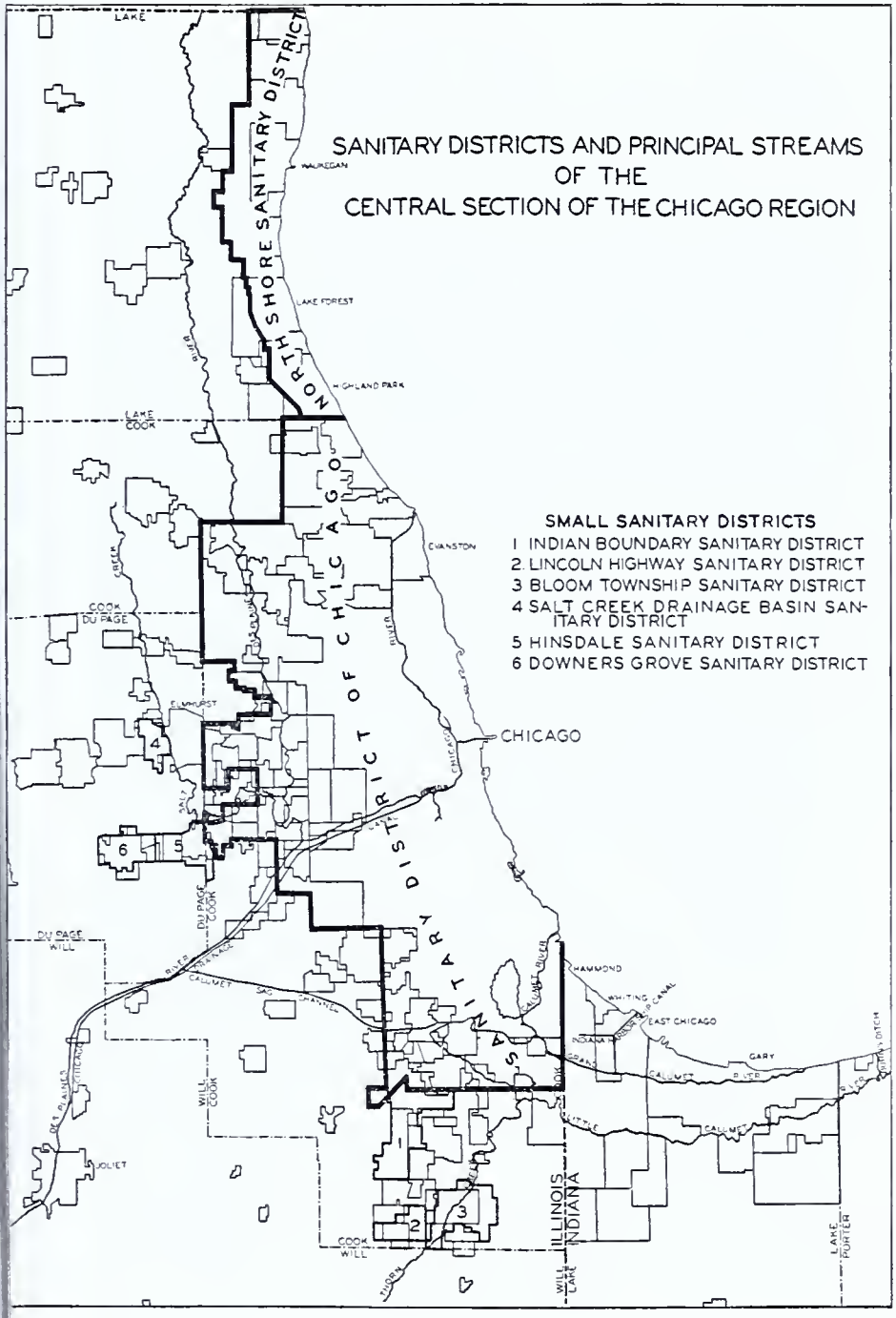
THE QUALITY OF WATER SUPPLIES—LAKE MICHIGAN POLLUTION

The pollution of Lake Michigan by sewage and industrial wastes affects both the biological and physical quality of water supplies taken from this body of water. Industrial wastes discharged into the Lake are responsible for the chlorophenol, oil, and other tastes and odors in the water supply of Chicago and other water systems. The absorption of chlorine by phenol, which reduces the amount of chlorine available for disinfection, and the employment of the Lake as a place for the disposal of sewage are a constant menace to the safety of the source. The problem of reducing this pollution has gradually expanded from the city of Chicago to its suburbs, until it embraces a large part of the Region. In recent times the problem has become national, and even international, in character. The Sanitary District of Chicago was created in 1889 and gradually enlarged to meet this growing problem, but the responsibility for its solution is still largely divided among a multiplicity of governments.

I. THE CITY OF CHICAGO AND THE SANITARY DISTRICT OF CHICAGO

After struggling with its local sewage problem for almost a century, Chicago has, temporarily at least, diverted its pollution from the Lake. Almost from the beginning of Chicago's history, the city was confronted with the task of preventing the contamination of its water supply. The

MAP III


SANITARY DISTRICTS AND PRINCIPAL STREAMS
OF THE
CENTRAL SECTION OF THE CHICAGO REGION
SMALL SANITARY DISTRICTS
1 INDIAN BOUNDARY SANITARY DISTRICT
2. LINCOLN HIGHWAY SANITARY DISTRICT
3 BLOOM TOWNSHIP SANITARY DISTRICT
4 SALT CREEK DRAINAGE BASIN SANITARY DISTRICT
5 HINSDALE SANITARY DISTRICT
6 DOWNERS GROVE SANITARY DISTRICT
NORTH SHORE SANITARY DISTRICT
METROPOLITAN SANITARY DISTRICT OF CHICAGO
CHICAGO
EVANSTON
WAUKEGAN
LAKE FOREST
HIGHLAND PARK
ELMHURST
HAMMOND
EAST CHICAGO
GARY
JOLIET
ILLINOIS
INDIANA
LAKE
COOK
DU PAGE
WILL
CALUMET RIVER
DES PLAINES RIVER
CHICAGO SANITARY AND SHIP CANAL
WHITING
LAKE MICHIGAN
LAKE PORTER

first water system with the Lake as a source, which was completed in 1840, had its intake not far from the mouth of the Chicago River, which was at that time quite pure. But as the population increased, the River water and the Lake water adjacent to the River gradually became contaminated; and after the first sewers were constructed in 1856 this contamination became excessive. At this early date some of the sewage in the Chicago River was being diverted to the Des Plaines River by way of the Illinois and Michigan Canal, which had been completed by the state of Illinois in 1848. In 1867 the first important measure to prevent the pollution of the water supply was taken—a water tunnel was constructed far out into the Lake. Meanwhile the city had obtained permission from the state to deepen the Illinois and Michigan Canal in order to divert more of the sewage from the Chicago River, and this work was completed in 1871. The city was growing so rapidly, however, that these efforts provided little relief. Finally, in 1889 the Sanitary District of Chicago was created to provide complete diversion for Chicago's sewage.[1]

Even at its inception the Chicago Sanitary District included territory outside the borders of the city proper; and since 1889 more and more territory has been added, until it embraces a considerable portion of Cook County, including parts or all of 61 communities. In 1903, a large area north of Chicago was annexed in order to divert the sewage of the North Shore towns from the Lake and to permit the construction of a channel to carry Lake water to flush out the North Branch of the Chicago River. In the same year, another large area south of Chicago was annexed so that

[1] "Report of the Engineering Board of Review of the Sanitary District of Chicago on the Lake Lowering Controversy and a Program of Remedial Measures." (Part II) *The Technical Bases for the Recommendations of the Board of Review.*

the Sanitary District might reverse the flow of the Calumet River through the Calumet-Sag Channel to the Chicago Sanitary Canal. Later annexations added a large area of territory west of Chicago, which turns its sewage into the Des Plaines River.

The Chicago Sanitary District is the only agency in the Region, and for that matter one of the few in the United States, which is dealing with metropolitan problems on a metropolitan scale. In order to carry out its original function, that of preventing Chicago's sewage from entering the Lake, it constructed the Main Channel between Lake Michigan and the Des Plaines River, reversing the flow of the Chicago River and diverting the sewage down the Illinois River to the Mississippi. After the annexation of the northern and southern territory, it built the North Shore Channel and the Calumet-Sag Channel to drain these areas. A network of intercepting sewers and pumping stations was constructed to serve the many communities in the District. The original plan was to render the sewage innocuous by diluting it with sufficient quantities of water. But some years ago the District realized that dilution would be inadequate as a permanent solution of Chicago's sewage problem, and began experimentation and the preparation of plans for sewage disposal works. At the present time the District is treating the sewage of more than one-fourth the population. In addition, the District has undertaken a number of other activities, some of which have become the subject of local and even national notoriety.[2]

Because it is the one comprehensive government in the Region, something might be said of its organization. The Sanitary District is an independent government created by the state with the usual taxing, borrowing, and rule-mak-

[2] The Sanitary District of Chicago, *Engineering Works* (August, 1928).

ing powers. It is governed by a commission of nine members, three of whom are elected by the people of the District every two years for six-year terms. Its annual budget has exceeded $70,000,000 and its total expenditures up to 1932 were $300,000,000. The work of the Sanitary District is not as conspicuous as that of the city of Chicago and of Cook County, nor the election of its commissioners as dramatic; and its activities have not been the subject of public scrutiny to the same extent as the activities of the two older governments. The result has been that the District has acquired renown for extravagance of expenditures and political irresponsibility. In spite of its defects, however, it has performed for the four million people within its jurisdiction the important service of turning most of the sewage out of the water supply to the great improvement of the health of the larger community.[3]

II. THE INDIANA CALUMET DISTRICT

Comprehensive in territorial scope as the Sanitary District is, the problem of protecting the water supply of the Region by reducing the pollution of the Lake has expanded beyond the boundaries of this governmental unit. Since the District has diverted Chicago's sewage and wastes from the Lake, the most important sources of pollution are the cities in the Calumet district in the Indiana section of the Region. The cities of Hammond, Whiting, East Chicago, and Gary, as well as a number of industries in these cities, are contributing sewage and wastes which are a constant menace to their own as well as to Chicago's water supply. Two of Chicago's water intakes are within one-third of a mile of the Illinois-Indiana boundary projected

[3] Merriam, Parratt, and Lepawsky, *The Government of the Metropolitan Region of Chicago.*

into the Lake; but while this line is a complete barrier to the exercise of authority by Chicago across the boundary, sewage and wastes drift across it constantly to pollute Chicago's water supply.

The sewage problems of these northern Indiana cities are closely interrelated and are also intertwined with those of the Sanitary District of Chicago. All four Indiana cities and the Sanitary District are discharging sewage and wastes into at least one of the two principal streams draining the area—the Little Calumet and the Grand Calumet rivers. These two streams parallel one another as they run through northern Indiana into the Chicago District, where they converge. Under natural conditions the Calumet River, formed by their confluence, carried their flow into the Lake in South Chicago. These natural conditions have, however, been altered considerably in recent decades. The Calumet-Sag Channel was constructed by the Sanitary District to divert part of the flow of the Calumet River system to the Chicago Sanitary Canal. The Indiana Harbor Ship Canal connects the Grand Calumet River with the Lake in East Chicago. At the eastern end of the Calumet District the Burns Ditch has been dug between the Little Calumet River and Lake Michigan. One other change in the direction of the drainage was not anticipated when the Indiana Harbor Ship Canal and the Calumet-Sag Channel were constructed; because of a deposit of sewage from the sewers of Hammond and East Chicago, a dam has been formed in the Grand Calumet River in Hammond.[4]

The result of the natural conditions and the alterations

[4] "Report of an Investigation of the Pollution of Lake Michigan in the Vicinity of South Chicago and the Calumet and Indiana Harbors, 1924–25," *Public Health Bulletin No. 170.*

is that a greater part of the sewage from the Little Calumet and a small part of the sewage from the Grand Calumet are carried down the Sag Channel to the Chicago Sanitary Canal; but a reversal of flow in the Calumet River constitutes a potential source of occasional pollution of the Lake, and sewage from the Indiana Harbor Ship Canal and the upper Grand Calumet, which includes nearly all of the sewage and wastes of Gary and East Chicago, constantly flows to the Lake. A small part of the flow of the Little Calumet River flows into Lake Michigan through Burns Ditch. In addition, the cities of Hammond and Whiting and a number of industries are discharging sewage and wastes directly into the Lake. It was estimated recently that the sewage from a population of 163,000 immediately or ultimately reaches Lake Michigan; in addition, millions of gallons of industrial wastes containing objectionable taste-producing compounds enter Lake Michigan daily.[5] The amount would be still greater, if it were not for the fact that the Chicago Sanitary District has diverted some of the pollution down the Calumet-Sag Channel, another illustration of the tendency of the small suburbs to lean on their larger neighbor.

Considerable effort has been expended in recent years to bring about a reduction of the pollution of the Lake on the part of these municipalities; but almost nothing has been accomplished, because of their unwillingness to co-operate and because of the neglectful attitude of the state. As early as 1919, a committee of city engineers from Gary, East Chicago, Whiting, and Hammond, with Mr. Langdon Pearse of the Chicago Sanitary District, made a study of a proposed sanitary district which would include the four

[5] M. B. Reynolds and A. E. Gorman, *Chicago's Water Pollution Problem—Past, Present, and Future.*

cities. In 1920, a report was made by consulting engineers on sewage treatment for East Chicago alone. In 1925, Whiting, East Chicago, and Hammond employed engineers to investigate the possibility of a sanitary district which would contain these three cities. While this latter plan was being discussed, a proposal was made that the three cities be divided into three districts to conform to the natural drainage areas of the territory comprised in the three cities. When it became obvious that these schemes would fail, Gary, Whiting, and East Chicago drew up plans for their own treatment plants. Gary went so far as to construct one small plant, which, however, was never put into operation. East Chicago organized a Department of Public Sanitation under a state sanitary district law and had complete plans developed for the treatment of its sewage. Whiting might have gone ahead more rapidly if there had been a state law under which it could have exercised powers similar to those of the East Chicago Department of Public Sanitation. Hammond and Gary, as well as Whiting, have attempted to secure legislative action which will make it easier for them to finance treatment, without success.

The state of Illinois, the city of Chicago, and the Sanitary District of Chicago have attempted to co-operate with the state of Indiana and the northern Indiana cities in securing action. In 1924–25, these three governments and the state of Indiana and the United States Public Health Service investigated the pollution of the Lake in the vicinity of the Calumet District.[6] This co-operation illustrates the unity of the Region despite state lines, from the stand-

[6] "Report of an Investigation of the Pollution of Lake Michigan in the Vicinity of South Chicago and the Calumet and Indiana Harbors, 1924–25," *Public Health Bulletin No. 170.*

point of an unpolluted water supply. The attitude of Indiana toward its sister-state was accurately indicated, however, in a provision in a law passed in 1927 which forbade the polluting of the waters of the state, ending with this statement:

> Provided, however, that none of the provisions of this act shall apply to Lake Michigan or to any of the rivers, streams, or any of the artificial channels or drains which empty into Lake Michigan along the shore line of Indiana or Illinois.[7]

The officials of the Indiana State Board of Health realized the seriousness of the situation, for they issued an order in December, 1927, requiring the northern Indiana cities to adopt sewage treatment.[8] As already indicated, these cities did take some measures to start the movement toward sewage treatment, but the failure of the state legislature to provide adequate legislation, combined with the coming of the business depression in 1929, has prevented any positive action.

The city of Chicago and the Sanitary District, with the aid of the Chicago Regional Planning Association, have been rather successful in inducing some of the industrial plants in Indiana to treat their wastes before discharging them into the Lake. Since the winter of 1928–29, there have been periods when the water supply of Chicago has contained large amounts of phenol, which have combined with the chlorine in the water to produce a very disagreeable chlorophenol taste. The phenol has the further very dangerous quality of absorbing the chlorine, reducing the amount available for the purpose of disinfection. The city of Chicago soon discovered that the phenols came from six by-product coke plants, three of which were located in Illinois and three in Indiana; and an effort was made, with

[7] *Acts of Indiana* (1927), chap. 45, p. 126. [8] *Indiana Year Book* (1928), p. 585.

the aid of the two other ageneies mentioned above, to enlist the co-operation of the officials of these companies in reducing the amount of phenol which reached Lake Miehigan. After an agreement was reached with the companies in Illinois, whereby they treated their wastes or stored them during the times when the flow of the Calumet River was toward Lake Michigan, the three plants in Indiana also installed treatment processes. During 1931 and 1932, the periods and intensity of chlorophcnol tastes in the Chicago water supply were greatly decreased. In the winter of 1932–33, there was a recurrence of these tastes which resulted from the aeeumulation of phenol under and in the ice off the mouth of the Indiana Harbor Ship Canal during the extremely eold weather of December. Ordinarily these wastes are carried out into the Lake in small quantities and are not notieeable in the Chicago watcr supply; but in this period they were concentrated, and when the ice broke they floated in large quantities to Chieago's intakes. There also existed a new source of phenol wastes—an oil-refinery plant which discharged its wastes into the Grand Calumet River, from which they flowed through the Indiana Harbor Ship Canal to Lake Miehigan. The Chicago authorities have conferred with the representatives of this plant, and it is hoped that remedial measures will soon be taken. Since 1930 a new threat has come to the physical quality of the Chieago water supply from oil-refinery wastes originating in Indiana which are responsible for a "musty-oily" taste and odor. These wastes are a cause for real concern, because no eheap effective means of overcoming them is known. Whether co-operation will be adequate to solve this problem is yet to be seen.[9]

The pollution at the southern end of Lake Michigan con-

[9] M. B. Reynolds and A. E. Gorman, *op. cit.*

stitutes a most serious menace to the quality of the water supply of a large part of the Region, but the division of authority between two states and a number of local governments has hindered effective action. With the existing governmental organization, the reduction of the pollution depends upon the willingness of these separate governments and of private corporations to assume their responsibilities; and in the past they have more often than not been reluctant to do their part. At times progress has been so slow that the Chicago authorities have been tempted to take legal action through the federal courts; in the case of the industries in Indiana, there have been resolutions in the Chicago city council and the Illinois state legislature requesting that such action be taken.[10] So far, however, the governments and the industries have shown enough inclination to adopt remedial measures that Chicago has not been disposed to invoke the aid of the judiciary. Although judicial compulsion may be necessary if the Calumet district continues to procrastinate, a better method for solving this problem, which is of interest to both states, would be to create some form of organization which would represent the two states. The pollution of the Lake in the Calumet district is of even more immediate concern to the Indiana cities than it is to Chicago, and it would be greatly to their advantage to participate in an arrangement whereby it could be stopped; at the same time, if Chicago were represented, it would have the opportunity of safeguarding its own water supply.

III. OTHER LAKE-SHORE CITIES

Most of the other communities in the Region bordering Lake Michigan turn their sewage and wastes into the Lake

[10] City of Chicago, *Council Proceedings*, January 16, 1928, January 17, 1933; *Chicago Daily News*, February 9, 1933, editorial.

with little or no treatment. Michigan City discharges its sewage within a short distance of its water intake. While an engineering report on a proposed treatment plant has been made, no steps have been taken to construct it. Kenosha also turns its sewage into the Lake. It also has plans for sewage purification works which it has never executed.

In Lake County, Illinois, most of the cities and villages use the Lake as a place of sewage disposal, and the North Shore Sanitary District is endeavoring to provide treatment. While this District is the second largest *ad hoc* agency in the Region, it has probably contributed more to the complication of the already overcomplex governmental structure than to the solution of the sewage problems of the Region. It is giving primary treatment to the sewage of about one-half of the people of the District, but even this removes only a small part of the pollution. A disagreement between the city officials of Waukegan and the officials of the District as to the location of the treatment plant is delaying treatment of Waukegan's sewage, although it is emptied into the Lake within a mile of the water intake.[11]

IV. INLAND COMMUNITIES

The problem of reducing the pollution of the Lake is no longer restricted to the cities and villages bordering the Lake, but it is expanding to inland communities whose sewage disposal problems are inextricably associated with those of the municipalities bordering the Lake. Here, too, divided responsibility is preventing action. Three streams —the Des Plaines River, Salt Creek, and Thorn Creek— flow into the Chicago Sanitary District carrying sewage from localities not under the jurisdiction of the District. While the influx of this sewage complicates the problems

[11] Illinois Association of Sanitary Districts, *Seventh Annual Report* (1930–31), p. 82.

of the District, the latter has no authority over the municipalities which discharge into the streams.

Only three small villages outside the Chicago Sanitary District are emptying their sewage into the Des Plaines River at the present time. Two of these villages treat their sewage, but one provides no purification.

Nine municipalities turn their sewage into Salt Creek. Two of these communities provide no treatment at all for their sewage, and the extent and effectiveness of the purification varies greatly for the other seven villages.[12] In 1928, the Salt Creek Drainage Basin Sanitary District, which included Addison, Elmhurst, Villa Park, and some unincorporated territory, was organized to provide treatment on an intercommunity basis. Three sets of engineers were consulted regarding treatment works over a period of five years, but no construction ever occurred. Addison withdrew from the District in 1930. The people of Villa Park defeated a movement within its borders to withdraw in the same year by a very small majority. Finally, in 1932, although an engineering report showed conclusively that Villa Park and Elmhurst could provide sewage treatment at much less expense co-operatively than separately, Elmhurst withdrew. There is no better example of the character of the relationships of the small autonomous units or of the inability of these politically isolated sections to solve common problems than this.

Four municipalities discharge their sewage into Thorn Creek, one of which does not treat at all. Chicago Heights treatment is so poor that Thorn Creek is a veritable cesspool for several miles. The Bloom Township and Lincoln Highway Sanitary Districts were formed in the drainage

[12] State of Illinois, Sanitary Water Board, *Inventory of the Pollution of Salt Creek and Its Tributaries* (January, 1932).

area of Thorn Creek; but neither one has accomplished anything, and both have been decimated by disconnections. One other small sanitary district, the Indian Boundary Sanitary District, adjoined the Lincoln Highway District on the north and included territory which naturally drains into the Chicago Sanitary District. Besides the fact that these small districts have accomplished nothing, they are obstructive because they prevent the extension of the Chicago District to cover the natural area of the problem.

V. THE NATIONAL AND INTERNATIONAL ASPECTS OF THE PROBLEM

The problem of preventing the pollution of the water supply of the Region has become national and international in scope as a result of the diversion of water by the Sanitary District of Chicago from Lake Michigan to the Mississippi River. Several states bordering the Great Lakes have protested against this diversion, alleging that it lowered the level of the Lakes; and the Supreme Court of the United States has, at their request, rendered a judgment reducing the amount of water which may be diverted. The decision of the federal court came after a period of contention which extended over many years.[13]

Under the Act of 1889 creating the Sanitary District, the latter was required to divert enough water from Lake Michigan to dilute the sewage. In 1901, the Secretary of War, in a permit to the Sanitary District to divert water from the Lake, limited the amount which could be taken from Lake Michigan to 4,167 cubic feet per second. In order to comply with the requirements of the state law, the Sanitary District gradually increased the diversion as the population grew until, by 1907, the amount exceeded the

[13] The Sanitary District of Chicago, *Budget Report of the Chief Engineer for 1931.*

limitation by the Secretary of War. A question had arisen as to the power of the Secretary of War to prevent the Sanitary District from taking water for sanitary purposes, and after a conference of the President of the United States, the Secretary of War, and officials of the Sanitary District, it was agreed to have the courts determine this matter in a friendly suit. While the testimony was being taken in this case, the Sanitary District in 1912 applied to the Secretary of War for a removal of the limitation of 4,167 cubic feet per second. The Secretary of War refused this application after a hearing at which Great Lakes shipping interests and Canadian interests were represented, and the United States in 1913 instituted another suit to enjoin the Sanitary District from diverting more than 4,167 cubic feet per second. The two government suits were consolidated and tried as one case, the final decision of the United States Supreme Court being rendered in 1925. The Supreme Court upheld the authority of the Secretary of War and issued the injunction.[14] Immediately thereafter the Sanitary District applied to the Secretary of War for a permit to divert 10,000 cubic feet per second. After a public hearing at which Canadian interests and the shipping interests on the Great Lakes were again represented, the Secretary of War issued a permit to the Sanitary District to divert not more than 8,500 cubic feet per second.

Meanwhile, in 1922, the state of Wisconsin had brought suit in the Supreme Court to restrain the Sanitary District and the state of Illinois from diverting a greater amount of water than that authorized by the Secretary of War. After the Supreme Court decision of 1925, this bill was amended to ask that all diversion be restricted to such amount "as

[14] *Sanitary District of Chicago* vs. *United States*, 266 U.S. 405.

the court shall determine and permit as reasonably required for navigation from Lake Michigan to the Mississippi." Later the states of Minnesota, Ohio, and Pennsylvania joined Wisconsin as plaintiffs in the case; and Michigan and New York filed bills of complaint in the Supreme Court similar to that filed by the state of Wisconsin. Missouri, Kentucky, Tennessee, and Louisiana joined Illinois as intervening defendants. The opinion of the court was rendered in 1929, and the final decree in 1930.[15]

The decree provided that the diversion of water from Lake Michigan should be gradually reduced to 1,500 cubic feet per second by 1938. In its testimony during the case, the Sanitary District outlined a program of sewage treatment which would be required if the diversion were reduced, and the Supreme Court ordered that the District file a semi-annual report of progress on this program.

In 1932, the international interests in the diversion at Chicago were more fully recognized. The restriction placed upon the amount of this flow was included in the St. Lawrence Waterway Treaty between the United States and Canada.[16] This treaty has not yet been ratified, but its negotiation illustrates the fact that the development of the metropolitan community has resulted in the rise of problems which are not merely local in character.

While the problem of protecting the Region's water supply from pollution is expanding territorially, the governmental organization remains localized and decentralized. The interests which were defended by the Sanitary District in the water-diversion cases were not those of this District alone but were those of the Chicago Region. The state of

[15] *Wisconsin et al.* vs. *Sanitary District et al.*, 278 U.S. 367, 281 U.S. 696.

[16] The text of this treaty may be found in *Chicago Daily News Almanac and Year Book, 1933.*

Illinois, in whose name the case was defended, and which legally is responsible for protecting the rights of its subdivisions, actually took little part in the case. The division of governmental responsibility among many small units and at least two states does not accord with the unified activity of reducing the pollution of the Lake, which is no longer local but has become national and even international in scope.

How inadequately a disorganized system of governments serves the needs of the Region is emphasized by the events which followed the decree of the Supreme Court. Three governments—the Sanitary District of Chicago, the city of Chicago, and the state of Illinois—have varying degrees of responsibility for preventing the pollution of the water supply; and a fourth, the federal government, has rendered assistance. As a result of the decree, it is necessary to adopt some other method of purifying the wastes and sewage of Chicago than that of dilution. It has already been indicated that the Sanitary District has a program of sewage treatment. In July, 1932, the Sanitary District had to report to the Supreme Court that, because it was unable to raise the funds, it had made little progress on the sewage-treatment construction program.[17] Upon the protest of the Great Lakes states which were complainants in the lake-levels cases, the Supreme Court placed the responsibility for providing the revenue to finance sewage treatment upon the state of Illinois.[18] The state legislature has authorized the Sanitary District to issue bonds in sufficient amount to pay for purification works;[19] it was impossible, however, to sell these bonds in the open market, but

[17] *Semi-annual Report of the Sanitary District of Chicago of July 1, 1932, Made Pursuant to Decree of April 21, 1930.*

[18] 53 S. Ct. 671. [19] *Illinois Revised Statutes* (1933), chap. 42, sec. 328.

they were used as collateral for loans from the Federal Emergency Public Works Administration.

Even if the treatment plants are constructed by 1938, there is serious danger of pollution of the Lake after heavy rainfalls, when sewage may be carried out the Chicago and Calumet rivers by reversals of these streams. The only method by which it can be made certain that uncontaminated water is not supplied is filtration by the city of Chicago.[20] Here, again, the federal government will probably have to assist, and, in fact, has already been asked for aid by Chicago.[21]

These four governments may or may not succeed in providing a safe water supply. For whatever happens, however, it will be the people of the Chicago Region who reap the benefits or suffer the consequences; and there is no single responsible government which represents them. In other studies in the series of which this is a part, it has been suggested that a separate state of Chicago alone would be capable of solving the Regional problems analyzed.[22] The development of the national and international phases of the pollution problem indicates that some such unit is necessary for its solution. Now that the Chicago Region must seek the aid of the federal government, the creation of a state of Chicago might be the most effective agency for assuming the responsibilities which this involves.

VI. CONCLUSION

What was originally a problem of preventing the pollution of Chicago's water supply by its own sewage has be-

[20] City of Chicago, *Fifty-sixth Annual Report of the Department of Public Works* (1931), p. 18.

[21] See note 22, chap. iii.

[22] Merriam, Parratt, and Lepawsky, *op. cit.;* Steadman, *op. cit.*

come one of maintaining the purity of the Lake supply of a large part of the Region. From a local problem involving only the interests of the people of Chicago the reduction of the pollution of the Lake has expanded until it is not only Regional but also national and international in character. Meanwhile a governmental organization which is essentially unco-ordinated and disintegrated in spite of the creation of the Sanitary District of Chicago and its several annexations struggles falteringly to secure the action which is necessary to prevent this pollution.

The expansion of this problem to metropolitan dimensions indicates the desirability of a government which will have jurisdiction over the whole Region. Such a government could dispose of the sewage in accordance with the natural drainage areas, providing such treatment as is found necessary. It could represent the interests of all of the sections of the Region in their relationships with other states and the national government.

CHAPTER V

OPERATION OF THE WATER SYSTEMS

It is impossible to provide abundant quantities of water and to supply relatively pure water without some co-operation among the communities in the Region. This is not true of the performance of the operating activities, for the separate water systems can provide pumps, storage tanks, treatment plants and mains; they can design and construct improvements; they can eliminate waste; they can provide fire protection; and they can do their own local planning. Or, for that matter, they can flounder along without reducing waste or planning. The existence of considerable territorial unity of the communities, however, makes possible the co-ordination of many of these activities, or, where co-ordination is not possible, the widespread adoption of high standards of performance; and the demand for cheaper water makes them almost imperative. But the Region is divided into 168 different water systems which complicate mutual or balanced action.

I. PUMPING AND STORAGE

Pumping stations are maintained and operated for the purpose of drawing water from the source and providing the pressure to transport the water out into the distribution system and up to the first three or four floors of buildings. Storage tanks are erected to equalize the pressure over a period of time in which the demand for water may be great at one interval and small at another. As one travels about the Region, he finds it dotted with tall black

standpipes and bright shining elevated tanks towering over small brick pumping stations far below. Or he may find large, impressive pumping stations and ground reservoirs. The city of Chicago has no storage tanks, and its twelve pumping stations are of enormous capacity.

There is little co-ordination of pumping and storage facilities in the Region, although the possibilities for such co-ordination exist at many points. Of the 168 water systems in the Region, 148 have their own separate pumping stations. Practically all of these communities also have storage tanks. These include not only cities, towns, and villages which are drawing water immediately from the source but also a number which are securing their water from other municipalities. The provisions of the Sanitary District law require the supplying of water, but they do not guarantee adequate pressures. The result is that 15 of the communities which receive water directly from Chicago and the 2 villages of North Riverside and Wilmette which obtain water from Berwyn and Evanston, respectively, maintain their own pumping stations and storage tanks. One additional municipality purchasing from Chicago has provided a pumping station but no storage. There are only 8 communities whose facilities for providing pressure have been unified with those of Chicago, notwithstanding the fact that 33 cities, towns, and villages are supplied by the metropolis. There is even some uncertainty as to the value of the co-ordination that has been achieved, for zero pressures were recorded in Elmwood Park and other suburbs of Chicago without pumps and storage when a test was made one evening in the summer of 1931.[1]

[1] City of Chicago, *Fifty-sixth Annual Report of the Department of Public Works* (1931), p. 16.

Chicago's failure to provide its suburbs with pressure illustrates its failure to co-operate with its neighbors, but the latter are no more charitable toward Chicago. The latter city has asked a number of the water systems supplied by it to fill their reservoirs during the night hours when the demand in the central city is small, and many have contracted to do so. Yet when a test was made during the summer of 1930, it was found that many of the suburbs were taking water from Chicago at the hours of its peak load, in violation of the contracts.

Even though unification with Chicago has not been accomplished, it would appear to the advantage of the suburbs which purchase from it and are compelled to maintain pumps and storage to effect some co-ordination among themselves. Harvey does provide pressure to five communities purchasing from it, three other water systems supply pressure to three others, and Broadview and Westchester have combined to construct one pumping station and one elevated tank. Yet, in spite of these precedents, the other water systems have their own separate facilities. Cicero, Oak Park, Berwyn, River Forest, Forest Park, Stickney, and North Riverside form a compact group of contiguous communities, but have their individual plants. Niles Center and Morton Grove are adjacent, but operate in isolation. Calumet City, Dolton, and Harvey have separate pumping stations, although they are contiguous.

This multiplication of facilities to provide pressure is not necessary from an engineering standpoint, but is almost entirely the product of Regional disorganization. Chicago is able to supply pressure to a population of 3,376,438 and an area of 210 square miles within the city boundaries, as well as a considerable population and area outside, with 12 pumping stations and no storage. But in the remaining

area of less than 222 square miles in the Sanitary District of Chicago, supplying about 507,000 people, are 54 municipalities, 34 of which have their own pumping stations and storage tanks. A comprehensive plan which engineers of the water department of Chicago have proposed to supply all of the municipalities in Cook and Du Page counties and some of those in Will and Lake (Illinois) counties makes provision for 12 pumping stations.[2] These would replace more than 80 pumping stations and about an equal number of storage tanks which are found in communities other than the city of Chicago at the present time. If a unified governmental structure were established in the Region, a co-ordinated system of pumping stations and storage tanks would almost certainly be effected.

II. TREATMENT PLANTS

In the maintenance of treatment plants, there is a similar duplication of effort. Twelve filtration plants serve 17 communities which have a combined population of 283,176. The population utilizing the individual plants varies from Evanston and Wilmette, with a total of 78,571, to Long Beach, with 436. Six of these plants—in Evanston, Kenilworth, Winnetka, Glencoe, Highland Park, and Lake Forest—are serving 11 cities and villages which have a population of 125,236 and are concentrated in a compact area along the Lake shore north of Chicago. When Wilmette completes the construction of its filtration system, there will be seven plants serving these communities. Whiting and East Chicago have separate plants, although they are contiguous. Hammond, which nearly surrounds Whiting and East Chicago, has received a loan and a grant

[2] Facts supplied through the courtesy of J. B. Eddy, engineer, Water Pipe Extension Division, Bureau of Engineering, City of Chicago.

from the federal government to build a filtration plant; and when this is put into operation, there will be three plants in a very small area. The two water-softening plants are in the adjoining villages of Hinsdale and Western Springs.

So many plants are unnecessary to filter the water of so few municipalities and such a small population. Evanston, which alone has more water-consumers than the other 10 North Shore communities combined, has one plant and not six. The bureau of engineering of the city of Chicago has ascertained that three plants will be sufficient to serve the 3,753,719 people which it supplies with water at the present time. The luxuriance of treatment plants in the Region is the direct result of the multiplication of water systems.

III. WATER MAINS

Nor is there any more order or systematization in the providing of transmission and distribution mains in the Region. Harvey, Dolton, Blue Island, Stickney, and Berwyn supply 9 other communities from the transmission mains they have laid to Chicago; and Broadview and Westchester have constructed a joint main to the metropolis. The transmission mains of the other units which purchase water and the distribution mains of all of the water systems are arranged to fit only their individual needs.

Multiplication and duplication are characteristic of the transmission system. Within the village of Oak Park lie the mains by which Oak Park supplies its consumers, the transmission main by which Forest Park secures its water from Chicago, and the transmission main by which Broadview and Westchester obtain their water from Chicago. Berwyn and River Forest receive Chicago water at points which are on the boundary of Oak Park. River Grove's transmission main passes along the limits of Elmwood

Park, which is also supplied by Chicago. Morton Grove's main traverses Niles, Harvey's goes through Riverdale, Calumet City's crosses Burnham, and Niles Center's is laid in the streets of Tessville.

The lack of co-ordination in the distribution system can be stated only in general terms. It must be kept in mind that more than one-half of the municipalities in the Region are contiguous with other municipalities and that by maintaining the separate water systems the possibilities of arranging the gridiron in the most economical and effective manner are not realized. There are clear illustrations of this. Along nearly all of the boundaries of adjoining water systems in the Region there are two mains to supply consumers on either side of the boundary. Some consumers have found it more convenient to secure water from an adjoining community than from their own water system. Thus, Berwyn provides water to some householders in Cicero, and Cicero to some consumers in Berwyn and also in Stickney; Oak Park retails water in River Forest; Hammond, Indiana, sells water across the state line to a few industries in Calumet City, Illinois; and Chicago supplies over 8,000,000 gallons of water per day to a number of individual consumers outside its corporate limits. These arrangements might be cited as attempts to develop unity in the distribution systems, but in every case they are makeshift in character and contribute hardly at all to the coordination of the distribution systems of the Region. The difficulties of interstate planning are shown by a recent case in which the corporation counsel's office of the city of Chicago informed the water department that it might sell water to consumers in Hammond if the water meter were placed on the Illinois side of the boundary.[3]

[3] Merriam, Parratt, and Lepawsky, *The Government of the Metropolitan Region of Chicago*, pp. 157–58.

IV. DESIGNING AND CONSTRUCTION

All of the 168 water systems in the Region are at one period or another making improvements, and for the Metropolitan Area as a whole the work is continuous. The communities are constructing new wells, intakes, tunnels, pumping stations, treatment plants, storage tanks, and mains. They are making changes and repairing these works. Two phases of these undertakings which emerge rather distinctly are the designing of the works and the actual labor of construction.

The Chicago water system, simply because of its size, has the most complete organization for designing of any system in the Region. While the benefits of this organization might well be extended to many of its suburbs, municipal jurisdictions stand in the way of such co-operation. In the smaller communities only the most modest works are designed by the water department, and the more pretentious structures are designed by engineers or other persons outside the water department. Many of the municipalities have in their employ part-time or full-time engineers who do all of the designing for the local government. Local carpenters, plumbers, bricklayers, well-drillers, and other more or less skilled laborers are employed to make many of the plans. In larger communities, more of the designing is performed by the water department officials and employees and by consulting engineers, and less by persons who are not so well qualified.

The Chicago water department does all of its own designing. With a force of fifty employees, including designing engineers, structural designers, mechanical designers, engineering draftsmen, and a host of other officials, the division of water-works design is prepared to design improvements ranging from those of small to those of great

importance. The quality of the designing compares quite favorably with that of consulting engineers, so far as can be discovered; and the method of handling the work with a permanent staff has certain distinct advantages. The staff is familiar with local conditions over a long period of years, and there is always someone conveniently located to which designing problems can be referred. In addition, many overhead charges are avoided. With very few additions to the staff, Chicago could serve many of its neighbors; but the spirit of local independence which prevails in the Region prevents this territorial expansion of the larger city's facilities.

In the designing of distribution mains, division of responsibility has been carried to its extreme conclusion, for this activity has been divorced from the water department in most of the communities. In the Illinois section of the Region each municipality has a board of local improvements which has charge of the designing and laying of most of the mains. The engineers who draw up the plans are not accountable to the water department and in many cases are not even in close touch with it. In a few of the larger cities in Illinois some, and in Indiana most, of the mains are designed by the water department. This not only eliminates the expense of a separate set of engineers but is more conducive to the planning of the distribution system to meet the needs of the water consumers, for the water department officials have the data, experience, and point of view of the water system.

Chicago is also able to perform more construction with its own labor, again simply because of its size. Most of the construction of water works in the Region is the work of private contractors. To the extent that the water departments can maintain permanent organizations for this pur-

pose, however, they make improvements with their own labor. In the smaller water systems such work is confined to minor repairs and replacements. Larger cities, such as Kenosha, East Chicago, Hammond, Michigan City, Valparaiso, and Oak Park, are able to lay mains with their own forces. Aurora, Chicago Heights, Elgin, and a few other cities erect their own pumping stations, build pumps, and improve wells. The Northern Indiana Public Service Company, which operates the water system at Gary, has a permanent staff to carry on most of its own construction. The city of Chicago makes the most pretentious improvements with city day labor, however. In 1930, for example, the city was building the Chicago Avenue Lake and Land Tunnel, upon which it spent $750,000 in that year. While experts are not certain that construction by city day labor is preferable to construction by contract, in theory certain overhead charges are avoided, and in practice most of the water systems in the Region have followed this method, in so far as they are able to do so. Small communities are deprived of the opportunity of making the choice, and unfortunately the Region is split into a multiplicity of small units.

V. ELIMINATION OF WASTE

Every water system in the Region has made some effort to reduce the waste of water. Nevertheless, of the 1,150,000,000 gallons of water which are pumped on the average day, only about one-half is put to some useful purpose. The "use" of water, as the term is employed here, includes every legitimate use for domestic, sanitary, public, or industrial purposes and for every other purpose for which water is necessary or has any real value. The remainder of the water is wasted by escaping through leaks in the distribution system and through leaky pipes and leaky plumb-

ing fixtures on the premises of the consumer; much of the water which is not used is wasted wilfully, thoughtlessly, or carelessly by the consumer. This waste has been allowed to continue in spite of the fact that it costs about as much to supply water which is wasted as water which is used.

The diminution of waste in the distribution system is largely a problem of discovering the leaks, the repairing of the mains being a simpler matter. A number of excellent methods of finding the leaks are in use in certain sections of the Region, but municipal boundaries have prevented their extension to communities where the methods are not so good. Mechanical leak-locators are employed in some water systems; by listening at hydrants with ear phones, for example, it is possible to detect large leaks. Unusual demands for water—a heavy consumption in the hours after midnight or an extraordinarily large consumption at any time—come under suspicion in a few water systems and are subjected to observation. A small number of other municipalities check the total pumpage against the total consumption, as shown by the individual meters. It would seem that any carefully operated water system would do this, in order, at least, to find out how much waste existed. But the majority of the communities do not have master-meters to measure the pumpage, and only a few of these calculate the total consumption. These methods are all available even to the smallest water systems; yet a great many of the municipalities depend upon finding leaks almost entirely by waiting for the water to rise to the surface of the ground. Upon inaugurating comparisons of pumpage and consumption it is not uncommon to find 50 per cent leakage in the distribution system. When water-works officials admit, as many do, that they have a large

loss without having a water-waste survey, it is apparent that a check-up would show a large leakage. The failure of many communities to take even the simplest steps to discover the waste, when excellent methods are in use in other sections of the Region, is only another illustration of the rigidity of governmental boundaries.

By far the best method of detecting leaks is a pitometer survey, but not many municipalities in the Region have ever had such surveys. At Waukegan the unaccounted-for water was decreased from 50 per cent to 38 per cent in two years by this method. The city of Chicago is unique in having a regular force for making pitometer surveys. Special tests in advance of street-paving are made of hydrants, valves, water mains, and services in the street up to and including the stopcock at the curb by employees in the bureau of engineering. Nearly 17,000,000 gallons per day leakage were stopped by this means in 1932. An underground leakage section which functioned from 1926 to 1928 stopped leakage amounting to 6,586,172 gallons per day, an amount equal to Oak Park's consumption. Chicago could easily enough make pitometer surveys for many of its satellites if it were not for the fact that they are isolated politically.

By one or more of these methods a few municipalities have reduced the loss in the distribution system to a minimum of 10 or 15 per cent. Similar reductions might be made in other communities if municipal jurisdictions could be broken down and improved methods permitted to penetrate them.

The simplest method of eliminating waste on the premises of the consumer is by the installation of meters. Other than a few services here and there, almost all of the municipalities in the Region have metered all of the services.

Chicago, Whiting, La Porte, and Crown Point are outstanding exceptions to this rule. La Porte has metered 25 per cent of its services and 90 per cent of its water. Whiting and Crown Point have very few meters. In Chicago about 21 per cent of the services and 33 per cent of the consumption is metered. In accordance with universal experience, where the services are not metered and a flat rate is charged with no limitation on the amount of water which may be consumed, there is an enormous pumpage of water. Chicago pumps 297 gallons per capita per day, Whiting 256, and La Porte 149, as contrasted with other communities with complete metering in which the per capita pumpage is rarely above 125, and usually less than 100, gallons. The city of Chicago pumps more water on the average day than any other city in the world. Of this pumpage about one-half is lost through leaky service pipes, leaky plumbing fixtures, open faucets, and leaks in tanks on the premises of the consumer. Most of this plumbing leakage and wilful waste would be eliminated if universal metering were adopted. Unfortunately, the experience which has been accumulated by Chicago's neighbors and which conclusively proves the falsity of the arguments which have been advanced against metering has not been effective in the metropolis, for municipal boundaries are obstacles to the interchange of such information.

From the Regional point of view, the fact that Chicago has not metered its water is of greater significance because it has affected the service to the suburbs which are dependent upon Chicago for their water. It has already been pointed out that the failure to meter has delayed filtration and that Chicago's smaller neighbors must use water which is often objectionable in turbidity, tastes, and odors and which is, with great difficulty, protected from contamina-

tion as a result. The necessity of supplying the enormous quantity of water which is wasted has made it impossible for Chicago to provide sufficient pressure to its suburbs. The waste in Chicago increases the cost of water to the satellites. It discourages many municipalities from securing water from Chicago. Chicago already has sufficient tunnel and pumping capacity to supply the legitimate uses of all the people in the Region not only at the present time but also for many years in the future. The existing Regional disorganization does not deter Chicago from continuing the waste which is so detrimental to the interests of its suburbs.

VI. FIRE PROTECTION

The necessity of furnishing fire protection places a burden upon the water systems that is of considerable gravity. The water works must be larger in order to have available the water which is essential during a fire. Intakes must be larger, wells must be more capacious, additional pumps must be installed, auxiliary storage must be maintained, and extra filter units must be constructed. The mains must be larger: where a four-inch secondary main might be quite ample to supply all domestic needs, six-inch mains or larger are required for fire protection purposes. Hydrants must be installed and maintained, though this is only a minor activity.

All of the water systems in the Region provide fire protection.[4] There is considerable variation in the quality of

[4] In addition the small village of Hodkins has a well which is used for fire-protection purposes only. A hose which connects with the well is supposed to extend to all the buildings in the village. If the fire is fifty feet beyond the end of the hose, "it is just too bad," according to one of the village officials. Several subdivisions also have small supplies with hydrants, which were not included as water systems in this study. One of these small supplies in Midlothian was inadequate during a fire, and it was necessary to press a milk truck into service

the service, however. Water supplies are inspected and graded for fire protection purposes by the fire underwriters. In the 15 cities of over 20,000 population inspected by the National Board of Fire Underwriters, none of the water supplies rates first class for fire protection, 4 are second class, 4 third class, 4 fourth class, 2 fifth class, and 1 seventh class. None rates sixth, eighth, ninth, or tenth class, which are the most deficient classes. Of 69 other water supplies—all in Cook County and graded by the Chicago Board of Fire Underwriters—39 are good, 11 fairly good, 11 fair, 1 hardly fair, 2 poor, and 5 very poor. Data are not available for other water supplies, but these 84, constituting one-half of those in the Region, are probably a representative sample.

The deficiencies[5] in fire protection are the result mainly of inefficiency running through all of the activities of the water systems. There are two matters which are especially pertinent, however. One is the unnecessary expense of maintaining so many water systems for fire protection pur-

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and haul water three miles in milk cans. The building was a total loss (*Chicago Tribune*, May 3, 1932). Midlothian is a village of 1,775 inhabitants and is only a few miles from Blue Island and from Chicago. This is a good illustration of what occurs when small, autonomous units are left to provide their own water supplies.

[5] Among the deficiencies noted by the National Board in their general summaries for individual cities are the following: management frequently changed; employees appointed without civil service protection; records almost entirely lacking; emergency operations poor; intake subject to interruptions by ice conditions; supply from wells slightly inadequate and storage small; seriously deficient in reserve pumping capacity; arrangement of pumps contains many unreliable features, in which single breaks could cause a serious curtailment of the supply; station fire-resistively weak and seriously exposed; consumption high; pressures low; distribution system mostly inadequate; arterial and secondary feeders lacking or too small in many districts; gridiron system poor; many dead-ends; gate valves in poor condition—spacing wide, not inspected; hydrants rather widely spaced—a number of small type or poorly set.

poses. A large part of the cost of fire protection is for stand-by capacity, or additional works which are utilized only in case of fire but which are nevertheless absolutely essential. In a large unified water system the necessary stand-by capacity is proportionally much less than in a small water system. The required stand-by capacity is ordinarily auxiliary to the capacity to meet the maximum daily demand. The water works must also maintain additional capacity to meet the maximum hourly demands for non-fire protection consumption. In a large community the stand-by capacity for fire protection is about equal to, or less than, the capacity needed to meet the maximum hourly demands. In the small community the additional capacity necessary for fire protection will greatly exceed that necessary to meet the maximum hourly demand. The maximum daily consumption for Chicago in 1929 was 1,195,630,000 gallons. To meet the fire-flow needs, the water works would have to have a capacity of 28,800,000 gallons in addition, or a total of 1,226,430,000 gallons. But the maximum hourly rate was at a daily rate of 1,377,800,000 gallons, or more than the fire protection requirements. Kenosha in 1930 had a maximum daily consumption of 9,590,000 gallons. The maximum hourly demand was at a rate of 4,910,000 gallons per day greater than this, but for fire protection 9,500,000 gallons capacity above the maximum daily consumption was necessary. This stand-by capacity of 4,590,000 gallons above the amount required for maximum hourly demands constituted nearly 27 per cent of the total necessary capacity. Kenosha has a population of 50,000; for smaller communities the additional capacity for fire protection is proportionally greater.

Some co-ordination has already been achieved among

the communities in the Region. Municipalities which purchase their water profit from the stand-by capacity maintained by the water systems which purvey the water. Where communities are contiguous, they ordinarily have emergency connections, for which they are given some credit by the underwriters.[6] Great savings, as well as improved service, could be achieved by further co-ordination of stand-by facilities.

Sometimes active antagonism occurs instead of co-operation, as is evident in an incident which occurred in March, 1932, in "No Man's Land" between Wilmette and Kenilworth. This unincorporated area has no water system of its own, but the property-owners have contracted with Wilmette and Kenilworth at various times for a water supply. Wilmette withdrew its water services when difficulties arose regarding payment for water and for fire protection, and the residents then came to terms with Kenilworth. A fire broke out in "No Man's Land" at the Miralago building. The Evanston fire department attached their hose to a Kenilworth water hydrant and had the blaze practically under control until a Kenilworth police officer, insisting that the contract between the village and the Miralago corporation was only for a domestic water supply and not for fire protection, shut off the supply of water. As a consequence, the owners of the building have filed a $250,000 damage suit against the village of Kenilworth.

The other matter which influences the character of the fire protection afforded is the method of charging for this service. The fundamental difficulty with fire protection,

[6] Interview with Harold F. Hunter, engineer, the Chicago Board of Fire Underwriters.

according to the fire underwriters, is the fact that it is paid for out of water rates and not by a separate charge.[7] Most of the water systems in the Illinois section of the Region, where the Illinois Commerce Commission does not have jurisdiction over municipally owned water works, do not consider fire protection as a separate item but include the cost in the water rates. As a result, there is a tendency to overlook fire protection in the construction and operation of the plant. In Indiana and Wisconsin, the public utility commissions have been responsible for the introduction of a separate charge for fire protection, both in privately owned and municipally owned water systems. The annual cost of fire protection is determined and charged to the taxpayers, usually in the form of a hydrant rental. Without the advice of the state agencies, a few municipalities, including Batavia, Elgin, Kenilworth, Lake Forest, and Winnetka, make a distinct charge for fire service, although the amount is so small that it probably has little or no influence on the type of fire protection afforded. In Kenosha, nearly 30 per cent of the expenses of the water systems was attributed to fire-protection service; when it is realized that the percentage would be larger in most of the communities in the Region, the significance of the failure to consider this item is obvious. Again jurisdictional lines hinder the extension of better practices. Because of state boundaries a large part of the Region is left without state supervision, and municipal boundaries stand in the way of exchange of experience among the local water systems in this neglected section of the Region.

The state fire marshals have the authority to supervise the fire-protection service of water systems in so far as de-

[7] Interview with Clarence Goldsmith, assistant chief engineer, National Board of Fire Underwriters.

ficiencies in the service constitute a fire hazard. In one instance the Indiana State Fire Marshal Department ordered the city officials at Crown Point to instal a pump and equipment to improve the fire-protection facilities, but this was a unique case.[8] Generally speaking, the influence of the state officials has been slight. The vital impetus to the amelioration of fire protection comes from the fire underwriters. Their threat to continue high insurance rates results in some notable changes, but the governmental power to order improvements could be much more effective. In the confusion of a multiplicity of governments and governmental agencies, however, this power has not been exercised by the civil authorities.

VII. PLANNING

Future population growths are the very essence of waterworks engineering. Economical operation is dependent upon the planning of the water works to meet the future demands of consumers. If small mains are laid, they will have to be dug up later and replaced by larger mains. If tunnels are too small, supplementary tunnels will have to be constructed at a cost equal to that of the original tunnels; whereas a larger tunnel could have been built in the first place at relatively little additional cost. Inadequate wells, pumps, treatment plants, and other works will have to be augmented or replaced at an unnecessarily excessive expense. On the other hand, if mains, wells, tunnels, pumps, treatment plants, and other structures are made too large originally, the public's money will be spent uselessly. The anticipation of the water needs of the community will prevent the extravagant emergency measures

[8] *Lake County Star*, January 16, 1931.

taken by water systems to meet continually recurring crises.[9]

On a much larger scale, planning for the Region means a transmission system designed now to supply inland communities which at a future date must have Lake water, and a system of pumping stations and filtration plants of sufficient capacity to furnish pressure and treat the water for these municipalities.

Planning efforts in the Region are limited to a few water systems and are spasmodic in most of these. Engineers who are employed by the boards of local improvements and who are rarely water-department officials design the mains. The extent to which the fire underwriters point out the necessity for additional and larger mains in their inspection reports is evidence of the lack of foresight in the past on the part of these engineers. Most of the communities are thoughtful enough to lay mains before pavements are constructed. The forecasting of population growths and the planning of the water system in conformance with the forecasts have been the work largely of consulting engineers. Over an extended period of time, many of the municipalities have sought the advice of these engineering firms. Before designing any structures, they estimate the future population; their plans are based on these estimates. The product of the consulting engineers is quite outstanding in

[9] "Recently the capacity of the Elgin water works has been insufficient to meet the demands of the consumers, particularly in the summer season when the demand for the water is greatest. This condition has occurred periodically ever since the city adopted a public supply over 40 years ago. There is no city in the country blessed with more adequate sources of supply than Elgin. Deficiencies in the past have apparently been due to a failure to appreciate the fact that a successful water works must grow well in advance of the city, following a very definite program laid out in advance. An adequate water supply at the lowest cost is not possible without such a program" (Alvord, Burdick, and Howson, *Report on the Water Supplies of the City of Elgin* [November 12, 1931]).

the welter of unplanned water systems. However, consulting engineers are called in only at long intervals, and do not provide the continuity of planning which is so necessary.

There are only a few communities in the Region which conduct their own planning. Winnetka has a carefully designed plan of mains and extensions to the plant for a number of years in the future. Aurora, Brookfield, Evanston, Gary, Hinsdale, Riverside, and St. Charles are other municipalities which have done some forecasting in the past.

Chicago has carried planning much farther than any of its suburbs. For years it has been forecasting the growth of population and developing a program of improvements to anticipate population increases. Recently an organization was established in the water pipe extension division of the bureau of engineering to handle the planning activities.

A Planning Section with an Assistant Engineer in charge was organized in January, 1930. This section was directed to make a study of the data obtained from the books of the Bureau of Water in 1929 by the Statistical Division of the Comptroller's office. A total of 404,000 accounts was computed and data obtained have been tabulated. From the results of this survey it is possible to estimate the legitimate water usage in each type of building of similar occupancy already under meter control.

This study together with an occupation survey, pitometer surveys, characteristic meter curves and the census will make it possible to draw very accurate plans for required future extensions.

The occupation survey has been . . . . extended to cover all of the towns and villages in the Sanitary District which receive water from Chicago.[10]

The effort to extend the investigations to the municipalities in the Sanitary District is the only governmental attempt to develop a Regional plan. In fact, this section

[10] City of Chicago, *Fifty-fifth Annual Report of the Department of Public Works* (1930), p. 141.

envisages a water system with Chicago as the central transmitting agency which would supply municipalities in Du Page and parts of Will and Lake (Illinois) counties, as well as Cook County, and has drawn up plans for pumping stations to supply this area. To transform this plan into a reality, it will be necessary for Chicago to secure the cooperation of its neighbors, which is very difficult with the existing Regional disorganization.

Planning is prevented in most of the water systems in the Region solely because of their small size. On a Regional basis, it is hindered by the large number of jurisdictions which must be consulted in order to institute systematization. As long as the present disintegrated water-supply organization continues, there will be a recurrence of extravagant emergency measures which are the result of the lack of foresight.

VIII. CONCLUSION

The unification of the source of supply of 33 communities supplied by Chicago and of 4 other communities supplied by three other water systems, and the territorial compactness of most of the municipalities in the Region provide vast opportunities for co-ordination and interchange of experience. Economical areas for individual pumping stations, storage tanks, and treatment plants, for devising a system of mains, for fire protection, and for planning expand beyond local jurisdictions to areas almost as wide as the demand for better service at lower costs. The desirability of the adoption of the best methods of designing and construction and of eliminating waste is not restricted to a few localities but is found all over the Region. Yet the disintegrated water-supply organization impedes both systematic arrangement of the physical equipment and extension of improved methods, with the result that

inferior service and unnecessary expense are preserved at one and the same time.

If the best service at the lowest cost is to be gained in the Region, it will come only from a unified water system with as wide territorial jurisdiction as the problem itself. From a study of the activities of the existing water-supply organization one sees few prospects for improvement except through a water-supply authority which serves an area much larger than any single government at the present time. An integrated water system alone can perform the operating activities in areas which are large enough to be economical.

CHAPTER VI

PERSONNEL AND FINANCES OF THE WATER SYSTEMS

The selection and management of personnel and the administration of water-works finances are not the primary duties of the water-supply organization; nevertheless, the manner in which they are accomplished determines to a considerable extent how efficiently and economically the water organization carries out the more important activities which were discussed in earlier chapters. The personnel of the water systems is significant because the activities are technical, requiring special skills for their performance. Finances are important because both for capital outlays and for operation the expenses are large,[1] and because a special type of income in the form of water rates is employed to meet most of these expenses. In the types of personnel and in the methods of administering the finances, there are low standards and high standards. The compactness of the Region should facilitate the spread of the superior standards, but the multiplicity of water systems interferes considerably with this dispersion of better practices.

I. THE PERSONNEL OF THE WATER SYSTEMS

Variation and disparity are the chief characteristics of the personnel practices and the quality of the personnel in

[1] About $14,000,000 is spent annually to supply water in the Chicago Region. The combined governmental-cost payments and outlays for water-supply purposes of 10 of the 11 cities in the Region of more than 30,000 population were $11,960,302 (*Financial Statistics of Cities* [1929]). These 10 cities include 84 per cent of the population of municipalities with water systems; the expenditures for the other water systems were estimated.

the water systems in the Region. There are great differences and discrepancies in the types of officials and employees who are directing and operating the water works. In the methods of selection, in the bases of tenure, and in training there is a wide divergence which only emphasizes the lack of unity of the water-supply organization. Full-time service, selection upon the basis of ability to perform the duties of the position, permanent tenure, and adequate specialized training are the objectives of efficient personnel administration; but the disintegration of the water systems in the Region has resulted in large-scale failures to achieve these goals.

The divergence of types begins with the officials who decide general administrative policies. These include mayors, city councils, town presidents, town boards, village presidents, village boards, city commissions, village commissions, boards of public works, and water boards. It is among the officials who have direct charge of the water works, however, that the disparity in full-time and part-time service begins. In many of the larger water systems, there are superintendents of water, superintendents of water and light, commissioners of public works, commissioners of public property, commissioners of public health and safety, village managers, and boards of public works, who give full-time service to the community if not to the water department. This constant and continual supervision of the water works contrasts with the intermittent and casual surveillance of the work of the water department in the majority of the communities where municipal chief executives and legislative bodies are the only directing officials. In Cook County only about 25, and in the Region only about 50, officials who are directing the affairs of the water systems serve full time; and of these only about

10 in Cook County and 25 in the Region are giving all of their time to the supervision of the water department. The remainder give only a small part of their time to the functions of government, and even less to the activities of the water department.

The same differences are found among the water-works employees. These are the individuals who are performing the operating activities, the construction, maintenance, and operation of intakes, wells, pumps, treatment plants, mains, and meters, and the reading of meters, billing of customers, and collecting. In the larger water systems there are pump-operators, filter-operators, sanitary engineers, meter-readers, meter-inspectors, crib-keepers, addressograph-operators, clerks, and a profusion of other specialized types. In the smaller water systems—and these constitute the great majority—the administrative officials carry on some of these activities. There are, in addition, superintendents of water; superintendents of streets; chiefs of police; village marshals; city, town, and village clerks; local plumbers; and others without titular designations.

In these small water systems part-time employees are typical. The superintendent of water and streets is occupied part of the time with the water supply and part of the time with streets and sewers. The village marshal polices the village and also repairs mains and meters and reads meters. In Roselle, one individual is superintendent of water, superintendent of streets and sewers, operator of the sewage treatment plant, village marshal, building inspector, and member of the board of health. Combinations of these duties are characteristic. In other places the village plumber turns the pump on and off and spends a few days out of the year repairing mains; another person is hired for one day every three months to read meters; the village

clerk spends a few hours every three months sending out bills and a few minutes once a month keeping water accounts; the local bank collects the bills; and, finally, the individual in charge of the streets flushes the hydrants occasionally. Compare these water-works systems with those of Kenosha, with 32 full-time employees; Evanston with 34; Joliet with 39; Hammond with 40; and, above all, Chicago with 3,162. There are about 3,368 full-time and 155 part-time employees in Cook County and about 3,707 full-time and 337 part-time employees in the Region. All but 545 of the full-time employees are found in Chicago.

The selection of officials and employees upon the basis of their ability to perform the duties of the position they are expected to hold is seriously impeded in the Region by popular selection and political appointment. While most of the duties of the water departments are technical in nature, only Chicago has resorted to the merit system as a means of securing personnel with technical qualifications. Most of the individuals who determine general administrative policies, some of those who are in direct charge of the water systems, and many of the water-works employees are elected. The remainder of the members of the water-department staff are appointed by municipal chief executives or legislative bodies or by the heads of the water departments. In all of the communities except Chicago, the appointing officials have complete discretion in making their selections. The result is that proper political affiliations are often the chief qualifications of employees. "The village board appoints the employees; there are lots of politics in it," was the way one water-works official stated it. In Chicago, a majority of the employees who are engaged in water-works activities are selected upon the basis of ability shown in a civil service examination. While the

failure to adopt the merit system has not prevented the appointment of capable individuals in several of the water systems in the Region, Chicago's system is certainly much more conducive to the selection of a qualified personnel.

Elective terms and dismissal for political reasons prevent the majority of the water systems from reaping the benefits of long and permanent service. Many of the officials—including mayors, except in Chicago and Indiana cities; city councils; village boards; village presidents; and city, town, and village clerks—are elected for two-year terms. Others—including the mayors of Chicago and of the Indiana cities, city and village commissions, and town boards—are elected for four years. The members of the several water boards and of the boards of public works are appointed to serve for three, four, or five years. In almost all of the water works the remaining officials and employees are appointed to serve at the pleasure of the appointing official. The city of Chicago is outstanding in its protection of water-works officials and employees from improper dismissal, by civil service regulations. No member of the classified civil service may be removed, discharged, or reduced in rank except for cause, upon written charges, and after an opportunity to be heard in his own defense before the civil service commission. The water-works personnel are assured of permanent tenure unless they are incompetent.

In actual practice some water departments have frequent changes of personnel, while in others the members of the department hold their positions for long periods of time. No complete data were obtained on the point, but it is certain that in a considerable number of municipalities there is a change in personnel whenever a new administration enters office. "I have been in office one year, since the

election," is the statement of too many individuals. "The administration before the present one made a pretty general clean-up, and when this administration came in it got even," was the explanation of one employee. On the other hand, extended service is found in many water works. One elected commissioner has been head of the water department for sixteen years and another for twelve years. The technical nature of water-supply activities has hindered politicians in conducting marauding expeditions upon water-works personnel, particularly in the larger municipalities. Superintendents and other employees continue for ten, twenty, and even thirty years. In Chicago long terms of service are the rule. Experience is a very valuable part of training and its acquisition should be encouraged, but the multiplication of small water systems in the Region interferes with the adoption of measures which would guarantee long terms of service.

Differences in the amount and nature of training of water-department officials and employees are the natural result of the type of service, the method of selection, and the length of tenure. The elected officials are almost all politicians with little technical experience. Many of the administrative heads and employees are also political followers without any specialized training. Mechanics, laborers, bookkeepers, stenographers, plumbers, grocers, florists, and undertakers operate the water works in the majority of communities. In only a few systems are trained engineers, draftsmen, bacteriologists, chemists, and accountants present. The water department of the city of Chicago has a far greater variety of technically trained employees than any of the other Regional water departments. Many of its employees are graduates of colleges of engineering; others have taken university degrees in chemistry

or bacteriology; and some are expert accountants. Small water systems are unable to employ persons with such qualifications, and unfortunately most of the Regional water systems are small.

Notwithstanding the fact that efficient personnel practices have been worked out in certain sections of the Region, the majority of the water systems are following the less desirable methods. Some of the water systems are too small to adopt the better practices—the merit system, for example; and in others the political boundaries have prevented the extension of the efficient methods. Regional disorganization has in every instance contributed to the failures.

II. INTERNAL ADMINISTRATIVE ORGANIZATION OF THE WATER SYSTEMS

Closely related to personnel administration is the administrative set-up within the individual water departments. Disintegration is the outstanding feature of the control within the separate water systems, carrying the disintegration of the larger water supply organization one step farther. In reality, there is no water department in most of the water systems, but only autonomous groups of officials.

The creation of integrated water departments is not impossible, for Cicero, Evanston, Lake Forest, East Chicago, Hammond, Harvey, La Porte, Michigan City, and Valparaiso have placed all activities of pumping, filtering, maintaining the distribution system, repairing meters, reading meters, billing, and collecting under a superintendent whose sole function is that of administering the water system. The Home Water Company, which supplies Chesterton and Porter, also has a single line of control, since the

board of directors supervises the two employees. Most of the municipalities, however, have withstood the enticements of such modern and efficient organization.

In one type of disintegrated organization all water-supply activities are under a single head, who, however, has other duties as well. Thus, in Glencoe, Glenview, Kenilworth, Riverside, Wilmette, and Winnetka, the village managers have direct charge of the water works, but they have charge of many other activities of the villages. In Chicago Heights, the commissioner of public property, and in Aurora and Elgin, the commissioners of public health and safety, have complete control of the water works; but they have control also of such functions as streets, sewers, lights, and health. The directors of public works in Berwyn, Kenosha, Oak Park, and Western Springs have immediate control of all water-supply activities. In Gary, Long Beach, and La Grange privately owned utilities combine water supply with the supplying of electricity. Too much emphasis must not be placed upon the confusion of functions in these communities, for this type of organization is probably most efficient in these municipalities. Nevertheless, in a more comprehensive government the water department should be directed by an official who devotes all of his time to this one department.

Another type of organization, in which there are multiple lines of control, is indefensible. The most common administrative arrangement in the Region is that in which a part-time superintendent under the authority of the mayor and council or town or village board operates a pump and maintains the distribution system, and an elected city, town, or village clerk is in charge of the commercial activities. In some of the larger cities, this divided control is carried even farther. In Joliet, for example, there are

three lines of authority. A superintendent of water in the department of public property has charge of pumping, distribution, and meter-reading; the city engineer, who is appointed by the commissioner of public affairs, is in charge of all engineering work; collections and bookkeeping for services and meters are controlled by the commissioner of accounts and finance. In Waukegan, there are four lines of authority. Filtration and pumping are directed by a superintendent who is appointed by the board of trustees of Water Works Plant No. 2; the commercial activities and the maintenance of meters are performed by employees appointed by the same board but not responsible to the superintendent; Water Works Plant No. 1 is under a committee of the city council, and repairs the mains; and the city engineer who has the records is appointed by the mayor. Maywood and Highland Park may be cited as other examples of divided control.[2]

The Chicago water department may be classified under either of the disintegrated types of organization. All water-supply activities are under the supervision of the commissioner of public works. But two independent bureaus, the bureau of engineering and the bureau of water, carry on these activities; and the city engineer who controls the more important of these functions, and is in many respects the real head of the water department, has no control over the bureau of water. The superintendent of water has charge only of the commercial activities. The bureau of engineering has a number of other activities in addition to

[2] In Maywood, a superintendent of water directs pumping, a foreman of distribution supervises the maintenance of the distribution system, and the village clerk bills and collects. In Highland Park, the water superintendent, who has charge of filtration and pumping, the foreman of distribution, and the city clerk, who bills and collects, function independently of one another except for such supervision as given by the city commission.

that of supplying water, such as sewage pumping stations, the municipal power plant, and bridges and viaducts.

This is not the end of the dispersion of authority, for a large part of the control over construction of water works is not vested in the water departments at all. In Illinois, most of the water mains are constructed by the boards of local improvements. In Indiana, a large portion of the water mains are laid as local improvements, over which the water departments have slight authority. Pumping stations, filtration plants, and reservoirs are usually constructed under the supervision of the city councils and town and village boards rather than under the jurisdiction of the water departments which must maintain and operate them.

III. FINANCING PERMANENT IMPROVEMENTS

There are several ways in which water systems in the Region are financing new intakes, tunnels, wells, pumping stations, treatment plants, storage tanks, and mains or extensions to existing works. Many communities finance these permanent improvements out of current revenues and surpluses in the water fund. The city of Chicago has constructed a considerable proportion of its intakes, tunnels, and pumping stations and some of its mains by this method. Chicago Heights, Elgin, Evanston, Hammond, East Chicago, and Valparaiso have paid for some rather costly projects out of water-department earnings. In the larger Indiana cities most mains are financed in this way. Illinois municipalities construct some of the larger mains out of water revenues. The smaller water systems can only make minor extensions out of current receipts. This method has the advantage of encouraging the construction of improvements as they become necessary. Where this

method alone is employed, it has the disadvantage of delaying the largest extensions until adequate surpluses are accumulated.

Special assessments have been utilized extensively to finance water mains and in a few instances to pay for other structures. In almost all of the Illinois water systems, mains are laid by the boards of local improvements and their cost is charged to the property-owners. This method is not used so generally in Indiana. One of the most comprehensive projects financed by special assessments was the erection of a large transmission main, a pumping station, and a storage tank by the Broadview-Westchester joint commission. When Lake Forest purchased its water plant from a private company, the cost was defrayed partly by special assessments.

In order to finance improvements which are too expensive to pay for out of current revenues or by special assessment, it is necesary to borrow by issuing some form of bonds. The oldest and most common type of borrowing is to issue general corporate bonds. At least 21 municipalities have met the cost of water-works improvements by this method in recent years. Another plan of borrowing was provided by the Illinois legislature in 1899.[3] Municipalities of less than 500,000 population were empowered to issue certificates of indebtedness to be paid solely out of the water fund and to be protected by a mortgage of the water works. Many communities in the Region took advantage of this law before it was amended in 1931.[4] This method of borrowing has the advantage of permitting the

[3] *Laws of Illinois* (1899), pp. 104–6. An act of 1913, *Laws of Illinois* (1913), pp. 455–59, was very similar to that of 1899, except that it was for all municipalities.

[4] *Laws of Illinois* (1931), pp. 376–79. The amended act provided for the issuance of water revenue bonds instead of certificates of indebtedness.

municipality to pledge its water-works property in order to obtain a loan. The bonds often sell only at considerable discount, however, because the sanction, foreclosure of the mortgage, and assuming the operation of the water system is not efficacious. Another and more serious objection to this method, as well as to the first one, is that constitutional limitations on the amount of indebtedness apply to these provisions for issuing certificates and bonds. To communities which are bonded to the limit, or which wish to conserve their bonding power for other purposes, or which desire to construct some large improvement, general corporate bonds or water certificates are unsuitable.

Because of these limitations, the legislatures of both Illinois and Indiana have in recent years provided a third method. In 1921 Indiana passed a law permitting cities and towns to acquire water works and issue bonds to be redeemed out of water revenues and not to be considered a part of the debt of the municipality.[5] Illinois authorized cities, towns, and villages to issue water revenue bonds in 1927.[6] Both states have extended the original limited scope of the acts,[7] but the legislation has not kept up with the needs of Regional municipalities. All Indiana cities and towns are permitted to *acquire* water works, and fourth-class cities may make *extensions and additions* to water works by issuing revenue bonds. But second-, third-, and fifth-class cities do not yet have the power to borrow money in this way to make extensions and additions. Valparaiso desires to drill a well to maintain the level of the lake from which it secures its water supply, but must wait until it

[5] *Indiana Acts* (1921), chap. 96.

[6] *Laws of Illinois* (1927), pp. 337–41.

[7] *Indiana Acts* (1925), chap. 56; (1929), chap. 155; (1931), chap. 18. *Laws of Illinois* (1929), pp. 273–74; (1931), pp. 376–79.

can do so out of current revenues because it has exhausted the corporate bonding power and cannot issue water revenue bonds. Before it received a grant and a loan from the federal government, Hammond considered giving a private company the right to filter its water, because of the inability to issue the bonds to construct its own filtration plant.

The most desirable method of financing the water works in the Region would be that of borrowing money by issuing water revenue bonds to pay for extensive improvements and paying for smaller improvements out of current revenues. Mains might be laid by special assessment, although this sometimes delays needed replacements and improvements.[8] This plan of financing is seriously hindered in the Region (1) because the state legislatures are somewhat remiss in providing the necessary power to issue water revenue bonds and (2) because most municipalities are too small to finance extensions and replacements out of earnings.

IV. DEVISING RATE SCHEDULES

In an intelligently operated water system the cost of pumping and delivering the water is spread equitably among all classes of consumers. This is done by carefully devising the rate schedule. Large consumers ordinarily deserve a lower rate than small consumers because the overhead is proportionally smaller on large quantities. Minimum charges are necessary to pay certain overhead costs which are about equal for all consumers. Provision must be made for a demand charge to apply to consumers which may at particular times want large quantities of water, but which use, on the average, a small amount of water.

Few of the water systems in the Region have a scientifically devised rate schedule. Most rate schedules consist of

[8] L. D. Upson, *The Practice of Municipal Administration*, p. 503.

an arbitrarily determined minimum charge and a sliding scale. In addition to being arbitrarily determined, there are a few scales which have an excessive and unreasonable difference between the high rate to small consumers and the low rate to large consumers. While a ratio of one to two, or one to three, between the lowest and highest rates is considered large enough,[9] Aurora charges the smallest consumer nearly eight times as much as the largest consumer, Batavia nearly six times as much, Crystal Lake nearly five times as much, and several other cities, including Waukegan, East Chicago, and Gary, nearly four times as much. There are too many slides in many of the schedules. Three different rates, and four in municipalities in which there is an exceedingly large industrial use, are considered to be the proper number.[10] But many municipalities in the Region have over four. It is not uncommon to have eight, nine, and even ten slides. East Chicago has a different schedule for summer than it does for winter, the winter schedule having seven different rates and the summer eight. Michigan City sells water at nine different rates. With regard to many of these schedules, it is difficult to know whether to characterize them as ingenious or cumbersome.

Many water systems charge only a minimum and a single meter rate. While this is quite equitable in many systems, it is hardly so in the city of Chicago. The water department would like to give large industrial consumers a lower rate than 6.8 cents per 1,000 gallons, which it now charges all customers. But if it did so, it would have to sell water to suburban municipalities at the same rate. The fear that the latter would then be able to sell water to their consumers at a lower rate than Chicago sells to its domestic

[9] *Water Works Practice*, p. 463.

[10] *Ibid.*

consumers prevents the lower rate from being put into effect. One of the results of this failure to provide industries with a low meter rate is the continuance by them of the use of wells, which, as has already been pointed out, increases the difficulties that inland municipalities have in developing adequate ground-water supplies.

A few attempts have been made to devise scientific rate schedules in the Region. Winnetka, after considering the various factors determining rates, adopted a minimum charge and a single meter rate for all consumers. The city of Kenosha has a minimum charge for different size meters, and a sliding scale with five scales.

A quite different type of activity, but directed toward a similar end, is the testing of meters. If some meters underregister, the consumers whose meters register accurately will be paying an inequitable proportion of the costs of operation. In Kenosha, out of 3,102 meters tested, 850 (or 28 per cent) were unsatisfactory. While no data are available for other communities, it is probable that as great a proportion are unsatisfactory. Kenosha, in 1928, laid out a program which contemplated the testing of every meter once in six years.[11] Winnetka and Kenilworth test meters regularly. The city of Chicago tested about one-fourth of its meters in 1930. In most of the other water systems, the meters are tested only when there is some reason for repairing them.

V. ACCOUNTING METHODS

In order to provide continued good service at reasonable costs and to maintain the value of the water-works property, adequate accounting methods are very important. Information revealing the status of the enterprise depends upon true statements of assets, liabilities, income, and ex-

[11] *Annual Report of the Director of Public Works, Kenosha, Wisconsin* (1931).

penditures. Such statements cannot be secured without correct and complete accounting. While no attempt was made to study the bookkeeping methods of the water systems in the Region, an examination of a considerable number of financial statements revealed certain characteristics of the accounting methods.[12]

Few of the statements include a balance sheet of assets and liabilities. No effort is made to determine the value of the water-works property, and as a result it is allowed to depreciate year by year until the community suddenly finds itself confronted with the necessity of making large and expensive improvements. Municipal officials are able to exploit the property and give low water rates or low taxes.

There is rarely an income-and-expense statement. In municipalities which do not have a separate water fund, an itemized statement of cash receipts and disbursements is included in the general-fund account. Such a statement is practically worthless for comparative purposes. In most of the municipalities which do have a separate water fund, the water-fund statement is merely a balance sheet of cash receipts and disbursements. The profit usually shown is as deceptive as the totals are meaningless.

Most of the municipalities give no consideration to depreciation. It should be given attention in both the expenses of operation and the valuation of the assets. It is just as much a cost of operation as wages paid for labor or the price of electricity for pumps. The failure to deduct it from the assets gives a distorted picture of the value of the water-works property. Most important of all, however,

[12] A brief discussion of the management of the water funds of a few municipalities in the Region will be found in W. E. Karrenbrock, "The Administration of Municipal Funds with Special Reference to Illinois Cities" (Doctor's thesis, University of Illinois).

the omitting to set aside a retirement reserve—a fund from which depreciated works may be replaced—delays needed renewals and results in the dissipation of the public's investment.[13]

Under the supervision of the state public utility commissions, the privately owned water systems at Gary, Long Beach, Chesterton and Porter, and La Grange and the municipal systems at Kenosha, Hammond, East Chicago, Valparaiso, La Porte, and Michigan City have installed modern cost-accounting methods. Their statements follow the uniform classification of accounts of the National Association of Railway and Utility Commissioners. Winnetka has voluntarily adopted this system. Batavia, Geneva, Glencoe, Glen Ellyn, Highland Park, Kenilworth, Lake Forest, Oak Park, and Waukegan do not follow the uniform classification but have relatively good financial records. The uniform classification, besides requiring proper accounting methods, permits comparisons between municipalities. Many of the communities which determine the expense of operation also compute unit costs.

In most of the water systems in the Region it is impossible for the public or for officials to know the financial status of the water works. While modern methods have been adopted in certain sections, both state and municipal isolation have prevented their extension very widely.

VI. REPORTING

Reporting is the link between the water department and the public. Proper reporting affords the water consumers an opportunity to check up on the activities of the water department and to assume a more sympathetic attitude toward its efforts.

[13] Upson, *op. cit.*, p. 145.

The reporting in the Region is quite inadequate. A great many municipalities print a financial report annually in a local newspaper. Since this is ordinarily a simple statement of cash receipts and cash disbursements, it is of little value. A few water systems list assets, liabilities, income, and expense, which is somewhat more intelligible.

Reports of activities are almost negligible. Forest Park listed twelve water-department activities in its annual village report for 1929–30. Oak Park issues a bound mimeographed report annually, the one for 1931 having twenty-one pages. The village managers of Winnetka and Wilmette summarize the activities of the water department in a short annual statement. Valparaiso has distributed a one-page mimeographed account of its water system. One of the best water-department reports in the Region is drawn up in Kenosha. Containing a summary of the operations of the water system and amply embellished with graphs and illustrations, it provides an interesting and informative explanation of the work of the water department. The city of Chicago offers by far the most voluminous report of the water department. The 381 pages of the fifty-fifth annual report of the department of public works, the majority of which are devoted to the water system, constitute a virtual encyclopedia of facts, figures, and statistics. It has a mine of information for the snooping researcher, but one glance at its contents would discourage the ordinary water-consumer.

VII. WATER RATES

The disparity among the water systems is disclosed most distinctly in connection with water rates. For comparative purposes, the cost of supplying water as determined by accurate accounting methods would be the most pre-

cise measure; but the data for calculating such costs are exceedingly meager. As a substitute for this information is given the price at which the water is sold. It must be kept in mind that water rates are only very roughly comparable, for they do not allow for differences in the amount of profit and loss, methods of financing permanent improvements, quality, pressures, and numerous other facts that affect the rates.

Since most of the water systems distinguish between the small user and the large consumer in their rate schedules, a similar differentiation is made here. The maximum rates to small consumers vary from 6.8 cents per 1,000 gallons, the rate at which Chicago supplies its metered consumers, to $1.09 per 1,000 gallons in Plainfield. The latter rate is sixteen times that of the former. Among the cities with more than 20,000 population in the Region, the highest maximum domestic rate is 72 cents per 1,000 gallons, or more than ten times that of Chicago (Table IV). To eliminate certain peculiarities in the sliding scale, comparisons were also made of the cost of water to the average small consumer, through whose meter, it was estimated, passed 7,500 gallons per month. The lowest rate is 6.8 cents per 1,000 gallons. The highest is 60 cents in Joliet.

The lowest minimum rate to large users is 4 cents per 1,000 gallons in La Porte and Hammond, and the largest is 30 cents in Joliet. Only the cities over 20,000 are considered, because the others have only a minor industrial consumption. Chicago's 6.8 cents rate applies to large consumers.

One cannot fail to be impressed by the fact that the variations are very great. Against a background of unity of Regional social and economic interests of the people, the differences appear to be in conflict with these interests.

Since the variations in rates are the product of a number of factors, including the differences in accessibility to abundant sources, in qualiy of the raw water, in the methods of operation, and in personnel and financial administration, the conclusion is inevitable that the existing disintegrated water-supply organization has failed to co-ordinate and unify the water-supply facilities of the Region.

TABLE IV

WATER RATES PER 1,000 GALLONS OF CITIES OVER 20,000 IN THE CHICAGO REGION

	Maximum Domestic	Minimum Industrial
Chicago	$0.07	$0.07
Hammond	.10	.04
Michigan City	.10	.05
Cicero	.13	.13
Evanston	.16	.09
Kenosha	.20	.06
Oak Park	.20	.15
Berwyn	.22	.20
Maywood	.22	.14
Gary	.23	.05
East Chicago	.28	.06
Elgin	.27	.09
Waukegan	.35	.09
Chicago Heights	.49	.10
Joliet	.60	.30
Aurora	0.72	0.10

VIII. CONCLUSION

Variation, disparity, and discrepancy are the chief characteristics of the personnel and of the administration of the finances in the Region. While well-qualified officials and employees and high standards of financial practices exist in a few of the communities, poorly trained personnel and slovenly financial management are found in the great majority. These differences are the result, not of lack of

intercommunication between communities, but of an obsolete political system which hinders the exchange of information between the governments. The ultimate effect of retaining scores of small water systems appears in bold relief in a comparison of water rates, where the highest rates are more than sixteen times the lowest.

A large unified water system would make possible the adoption of better methods of selecting personnel and of administering finances. Many of the improved practices which cannot be adopted by the disorganized water systems because of their small size could be introduced in the larger system. The experience with modern methods gained in a few jurisdictions could be extended throughout the unified system.

CHAPTER VII

WATER-SUPPLY SYSTEMS IN OTHER METROPOLITAN AREAS[1]

The water-supply problems of the Chicago Region are not unique but are found with varying degrees of intensity in other metropolitan areas. Water resources are distributed unevenly among the many subdivisions. The quality of the water varies from suburb to suburb with different types of impurities. The physical propinquity exists to enable co-operation in operation to introduce economy and efficiency. A description of the water-supply organization in a few of these areas may serve to illuminate the problems of the Chicago Region.

I. BOSTON

It was in the Boston metropolitan area that water-supply problems first became acute in the United States. During the eighties the suburbs surrounding Boston were competing for the control of the few remaining desirable sources of water supply. Besieged with frequent applications for permission to develop these sources, the state legislature in 1893 directed the state board of health to report upon the advisability of creating a metropolitan district similar to the ones which had already been established for sewage and parks. In accordance with the rec-

[1] Much of the material in this chapter is taken from *The Government of Metropolitan Areas in the United States*, by the National Municipal League. The writer also submitted the material in manuscript form to the chief engineers of the respective water systems for criticisms and suggestions, but they should not be charged with responsibility for what is said here. Other references are noted.

ommendations of the state health board, the Massachusetts Metropolitan Water District was organized.[2] In 1901 the Metropolitan Water Board, which was constituted to manage the affairs of the District, merged with the Board of Metropolitan Sewerage Commissioners; and in 1919 the Metropolitan Water and Sewerage Board was consolidated with the Metropolitan Park Commission. The Massachusetts Metropolitan District Commission now has charge of water supply, sewage disposal, and parks in the Boston area.

The Commission functions as a department of the state government. A commissioner and four associates are appointed by the governor with the advice and consent of the senate for five-year terms. The legislature determines what projects the Commission shall undertake and what services it shall maintain. The expenditures are included in the state budget, but are paid by special assessments upon the water, sewerage, and park districts.

Among the accomplishments of the Commission is the development of a comprehensive system of watersheds, reservoirs, pumping stations, and transmission mains to serve the various communities in the District. The city of Boston and 19 other municipalities are now included in the Metropolitan Water District, and 18 of these municipalities are regularly supplied by the metropolitan supply works. Water is also furnished directly and indirectly to several municipalities not included in the District. The water is delivered to the several communities in wholesale quantities and distributed to the individual consumers by the local water departments. The Commission has control over local systems of distribution only in so far as it is essential to prevent unnecessary use or waste of water and to

[2] *Massachusetts Laws* (1895), chap. 488.

determine the districts in which the high service supply may be used. In order further to conserve the water supply, beginning in 1908, all the cities and towns in the Metropolitan Water District have been required by the legislature to equip all new services with meters and also to equip with meters annually 5 per cent of all the services which were unmetered in 1908.[3]

It was necessary to devise some method of financing the construction projects and operation and of apportioning the cost among the various municipalities supplied with water. The activities of the Commission are paid for by state appropriations and bond issues, but the communities in the District are assessed to reimburse the state for most of these expenditures. Two-thirds of the cost of operation, interest, and the sinking fund are collected on the basis of the amount of water consumed in the previous year and one-third on the basis of the assessed valuations of the municipalities. Communities which are in the District and which do not take water from the Commission are assessed only on the basis of one-fifth of their assessed valuation, and municipalities which secure water from an additional source receive credit for the same by agreement with the Metropolitan District Commission.

II. NEW YORK

In the New York metropolitan area, with 255 principal developed sources of water supplies,[4] the struggle to secure abundant quantities of water has been exceedingly frenzied. In 1905, in the New York State section of the region, the state legislature provided for the exercise of

[3] Morris Knowles and J. A. Fulkman, "Metropolitan Water Supply Systems," *Journal of the American Water Works Association*, XIII (1925), 611.

[4] Regional Survey of New York and Its Environs, *Physical Conditions and Public Services*, p. 75.

control over the allocation of water resources, by creating the State Water Supply Commission.[5] All new or additional sources of water supply must be approved by the Commission.

In passing upon plans thus submitted to it, the Commission is empowered to determine: (1) whether the proposed plans are justified by the public necessities of the community; (2) whether the plans are just and equitable to other communities, special consideration being given to future as well as present needs for water supplies; and (3) whether the plans make fair and equitable provision for the determination and payment of any and all damages, both direct and indirect, which will result from their execution.[6]

The state of New York has recognized the communal, as opposed to the individual, rights of the people to the water resources and has grasped the importance of planning for the future.

In 1905 there was also enacted a law creating the Board of Water Supply of the City of New York. It is the duty of this board to construct projects for obtaining additional supplies of water for the city. Carrying out this obligation, it constructed in the years 1907–26 the Catskill Aqueduct 160 miles from the city to impounded supplies which it developed in the Catskill Mountains, the total cost being about $188,000,000.[7] Under a provision of this same law, a dozen or more communities in the neighborhood of the Aqueduct in Westchester County receive a supply of water from the Aqueduct. This constitutes the sole co-operation of New York City with its suburbs in regard to water supplies. Until 1928, the satellite suburbs paid the same rate for this water as consumers in the city paid. In that

[5] The State Water Supply Commission has been superseded by the State Water Power and Control Commission.

[6] H. W. Persons, *Water Resources of the State of New York*, p. 10.

[7] Regional Survey, *op. cit.*, pp. 36, 38, 48.

year the legislature provided that these communities should pay only the actual cost of the water, eliminating the cost of distributing the water within the city limits. The rates were to be agreed to by the communities and the Commissioner of Water Supply, Gas, and Electricity; in case of disagreement the State Water Power and Control Commission was to fix the price, with a right of appeal to the courts. In accordance with this law the rates were substantially lowered.[8]

In the New Jersey section of the New York region, it has long been recognized that the state must grant the right to develop water supplies.[9] Before 1907, the state legislature passed upon requests to exploit the various sources of water. In 1907, a State Water Supply Commission was created to exercise functions similar to those of the body with the same name in the state of New York. Shortly after this, the state government attempted to procure water supplies for the various territories, but failed because of a judicial decision holding that a bond issue for this purpose must be affirmed by a state-wide referendum. This failure led directly to the passage of the District Commission Act of 1916.[10]

The District Commission Act divided the state into two districts, and provided for the creation of a commission in each of the districts at the request of any one municipality in the district. Each commission is to have four members appointed by the governor for four-year terms. The function of the commission is to develop water supplies upon

[8] New York City, Department of Water Supply, Gas, and Electricity, *Annual Report* (1928), pp. 5, 27.

[9] H. T. Critchlow, "Water Supply Situation in New Jersey," *Journal of the American Water Works Association*, XVI (1926), 801–11.

[10] *Laws of New Jersey* (1916), chap. 70.

the application of any municipality in the district. The commission contracts with the municipality and, in case there is more than one municipality, allocates the water among the several applicants. No municipality in the district may obtain a new or additional supply without the consent of the commission. The cost of the construction of the project is apportioned among the communities supplied on the basis of the amount of water contracted for, and the cost of operation on the basis of the actual water consumed. The commission has no authority to borrow money, but is dependent upon the municipalities, which are authorized to issue bonds, for its funds. The permission of the State Board of Conservation and Development, which assumed the functions of the State Water Supply Commission in 1916, must be secured before the commission can develop the supply. The commission wholesales the water, the individual municipalities attending to the distribution and sale of the water to local consumers.

At the request of Newark, the North Jersey District Water Supply Commission was established in 1918 and immediately began formulating plans to develop the Wanaque project. By 1924, seven other municipalities had petitioned to be included in the scheme. The project was put into operation in 1930.

The rapidly growing demand for additional sources of water in the New York area, as well as in southern New Jersey and in Pennsylvania, made the Delaware River a very desirable source of supply. Since its watershed lies in three states, however, there was considerable uncertainty as to the rights of the three riparian proprietors. As a result, in 1923, the three states appointed commissioners to draft a compact for the control of the diversion of water from the River and its tributaries. The Delaware River

Tri-State Compact was negotiated in 1925.[11] The state of New York ratified the compact, but the other two states wished to negotiate further. In 1927, a revised compact was drafted by the commissioners of the three states. This, too, was accepted by the state of New York,[12] but again failed of adoption by the other two states. In 1929, the state of New Jersey in an original action before the Supreme Court of the United States sought to enjoin the state and city of New York from proceeding with any plan for the diversion of water from the Delaware River or any of its tributaries. The injunction was denied, and the city now has the right to proceed with the first two stages of its contemplated development of an additional water supply from the Delaware River watershed within the state of New York.

III. BALTIMORE

In the Baltimore area there are only a few political subdivisions, which has made co-ordination of the water supplies relatively simpler than in other metropolitan regions. Most of the Region outside the city of Baltimore lies in Baltimore County, which in 1852 was separated from the city. In 1924, a large part of the county was constituted the Baltimore County Metropolitan District for purposes of supplying water, sewerage, and drainage.[13] The county commissioners who are vested with the control of the affairs of the District are empowered to divide the county into water subdistricts and to construct and operate water works in the districts. At the request of the commissioners, the city of Baltimore is directed to extend its

[11] Felix Frankfurter and J. M. Landis, "The Compact Clause of the Constitution," *Yale Law Journal*, XXXIV, 747.

[12] *New York Laws* (1927), chap. 682.

[13] *Laws of Maryland* (1924), chap. 539.

water-supply service into the District. The commissioners instal the water mains, after which the city of Baltimore assumes the operating control of the water system, including billing and collecting from individual consumers and maintaining the distribution system. The commission may condemn existing private water supplies and incorporate them into the District system. The cost of construction or acquisition is financed by special assessments on the property within the subdistricts. Expenses for maintenance and operation are met by water rates. The city of Baltimore determines the cost of extensions and installations made by it and fixes the rates to consumers supplied by it, subject to review by the Public Service Commission of Maryland. The commissioners fix the rates to consumers supplied by the District's works. They are empowered to issue bonds.

In Anne Arundel County a Sanitary Commission was created in 1922.[14] Composed of two members appointed by the county commission and one appointed by the State Board of Health, it was empowered to divide territory into water districts, construct water systems which are financed by special assessments and water rates, and issue bonds. It can contract with existing systems for a water supply. Under this authority it has installed water systems and transferred their maintenance to the city of Baltimore. In 1931, the town of Eldridge in Howard County was negotiating with the city of Baltimore to extend its water service into that community.[15]

Under mandatory state legislation and by co-operation with the surrounding political units, the city of Baltimore

[14] *Ibid.* (1922), chap. 245.

[15] City of Baltimore, Department of Public Works, *Annual Report, 1931*, p. 22.

has become the producer and distributor of water for a large part of the metropolitan area. The extensions into the suburban areas are "made in accordance with the lay-out for the ultimate distribution system in Baltimore County."[16] Not only has a method been devised for providing water to communities which are not blessed with readily available sources, but a planned co-ordinated system is being developed.

IV. WASHINGTON

The most interesting development in the Washington metropolitan area is the Washington Suburban Sanitary District, which was established by the state legislature of Maryland in 1918.[17] Created originally for the purpose of disposing of the sewage of the suburbs in the District, it was given the additional power of supplying water, controlling plants and the installation of all underground utilities, the making and enforcing of plumbing regulations, and the collection and disposal of garbage. The District includes parts of Montgomery and Prince George counties in the state of Maryland. Its affairs are managed by a commission of three members, two of whom are nominated by the Maryland State Board of Health and appointed by the county commissioners of the respective counties, and one who is appointed by the governor.

The commission is empowered to divide the District into water districts, to construct and operate water systems, and to purchase existing systems. The commission may borrow an amount not exceeding 14 per cent of the assessed valuation of the District, and for a period not exceeding fifty years. Such bonds must be approved by the Public Service Commission of Maryland. The fixed charges are

[16] *Ibid., 1927*, p. 77.

[17] *Laws of Maryland* (1918), chap. 122.

met largely by front-foot benefit charges on the property abutting on the water mains. A tax may be levied on the whole District to pay any costs that are not borne by special assessments or other revenues. There are special charges for house connections. The expenses of operation are defrayed by water rates.

The District has accomplished the rather significant function of supplying filtered water to a sparsely settled area of 102 square miles and about 65,000 population. It has acquired by purchase all of the existing water systems.[18] "The Washington Suburban Sanitary District has produced admirable results in a short space of time."[19]

V. CLEVELAND AND CINCINNATI

In the metropolitan areas of these two Ohio cities, the county governments, under the authority of a general law, have acted to induce co-operation among the many communities. The county commissioners have been empowered to create sanitary districts and provide water supplies for these districts. The performance of these duties is vested in both Cuyahoga and Hamilton counties in county sanitary engineering departments. In unincorporated territory the sanitary districts are formed without local consent and in incorporated areas at the request of the local governing bodies. The sanitary engineering departments construct the mains and assess all of the costs, including those of the department employees against abutting property-owners.

The cities of Cleveland and Cincinnati supply the water; they wholesale it to some villages which distribute it themselves, and furnish it directly to the consumers in other

[18] *Journal of the American Water Works Association*, XVIII (1927), 652–53.

[19] National Municipal League, *op. cit.*, p. 326.

villages and in unincorporated territory. The central cities maintain transmission and distribution systems outside of organized areas also. One of the most important features of these metropolitan systems is that the plans for the outlying areas must be approved by the water departments of the respective cities. The Hamilton County Sanitary Engineering Department, it is reported, has a master plan of water-line development for the county.[20]

In addition, both of the central cities have contracted to supply numerous suburbs with water.

VI. DETROIT

The city of Detroit is supplying a number of suburban communities, some directly and some indirectly through intervening municipalities. There is no law requiring Detroit to furnish this water, and it has been able to exercise considerable control over its satellites. Third-tier suburbs must secure the permission of the central city to secure water from intervening communities. The water department has worked out a plan for the region it may reasonably supply, and insists that municipalities which are supplied by it lay their transmission mains according to the plan.[21] All pipes, fittings, and other equipment installed by municipalities or unincorporated areas supplied by the city must conform to standards of material and workmanship required by the Detroit Board of Water Commissioners and must be installed under the inspection of the Board. In the case of the North Woodward Avenue System, the Water Commissioners exercise even more control,

[20] Cincinnati Bureau of Governmental Research, *Report on the Organization and Administration of the Sanitary Engineering Department, Hamilton County, Ohio* (October, 1931).

[21] W. W. De Berard, "Regional Engineering, Its Problems, Status, and Future Requirements," *Engineering News-Record*, CI (1928), 761–62.

for the city of Royal Oak, which operates the system, must make annual reports to the Detroit Board, submit its accounting methods and plans for extensions to the Board for approval, and permit Detroit to decide any disputes which arise over rates between it and communities which it supplies.[22]

VII. KANSAS CITY (MISSOURI AND KANSAS)

Since the metropolitan area of Kansas City lies in two states, it will not be surprising to learn that the most significant development in that region has been one of interstate co-operation. The water works plant of Kansas City, Missouri, is located in Kansas City, Kansas, and is connected with the water works of the latter city so that the two systems are able to interchange facilities in case of necessity. The former city co-operates with the latter in protecting the banks of the river. It also supplies Rosedale, Kansas, with water. When Kansas City, Missouri, was considering the construction of extensive improvements to its plant in 1921, the legislatures of the states of Missouri and Kansas were induced to enter into an interstate agreement providing for the exemption from taxation of water-works property which is located in the neighboring state and for the mutual exercise of the right of eminent domain.[23]

VIII. SAN FRANCISCO–OAKLAND

While the city of San Francisco is carrying through the Hetch-Hetchey project to transport water from the mountains 175 miles away at a cost of more than $40,000,000, Oakland, Berkeley, Alameda, and other communities on

[22] Information obtained by courtesy of the Board of Water Commissioners of the City of Detroit.

[23] Frankfurter and Landis, *op. cit.*, p. 747; *Laws of Kansas* (1921), chap. 304.

the east side of San Francisco Bay are not included in the plan. Inasmuch as San Francisco was engaged in a controversy with the private company which was supplying it water at the time and was not likely to complete the Hetch-Hetchey project for several years and because of their very pressing water needs, the suburbs in 1923 organized to seeure their own supply of water. The East Bay Municipal Utility District was formed by nine municipalities, including Oakland, Berkeley, and Alameda, under a general law.[24]

This law authorizes the establishment of municipal utility districts, not only to supply water, but also to provide light, power, heat, transportation, telephone service, other means of communication, and means for the disposal of sewage, garbage, and other refuse matter. Distriets may be created upon the initiative of individuals or the governing boards of municipalities, and after a referendum. They are administered by boards of five members elected from the five wards into which the districts are divided, upon a general ticket. The boards have complete power to acquire, construct, maintain, and operate water works. They may issue bonds and levy taxes to meet any debt charges whieh the revenues from the utility are inadequate to pay. In so far as possible, the water system must be self-sustaining, however.

To supply a present area of 125 square miles, a present population of 500,000, and an estimated 1970 population of 1,540,000, the District has developed a source of supply 100 miles distant on the Mokelumne River in the Sierra Nevada Mountains. It has constructed the Pardee Reservoir, and the East Bay Aqueduct leading from this to the District, and has purchased the distribution system of the

[24] *California Laws* (1921), chap. 218.

East Bay Water Company. The District maintains and operates the distribution system.[25]

IX. LOS ANGELES[26]

One of the most recently organized water districts is the Metropolitan Water District of Southern California, which includes Los Angeles and 14 of its suburbs. Organized under the Metropolitan Water District Act of 1927, it is governed by a board of directors consisting of one member from each municipality, with an additional director for each $200,000,000 in assessed valuation, appointed by the chief executive officer with the consent and approval of the governing body of each municipality. Voting power is apportioned according to each $10,000,000 of assessed valuation, with no one community having more than 50 per cent of the total votes. The board of directors is empowered to exercise complete authority in providing a water system, with the limitation that it will wholesale the water to the various municipalities which will distribute it themselves. It may issue bonds, levy taxes, and fix rates. The act goes into considerable detail in enumerating and elaborating the powers of the District.

The District was created primarily to construct an aqueduct 252 miles to the Colorado River, where the Boulder Dam stores the water of that River. It has entered into contracts with the federal government to save and deliver water from the River to the South Coastal Plain and to furnish electric power to the District to pump the water over intervening mountains. A $220,000,000 bond issue has been authorized by the District.

[25] F. W. Hanna, "The New Water Supply of the East Bay Municipal Utility District," *Journal of the American Water Works Association*, XXIII (1931), 14–21.

[26] E. A. Cottrell, "The Metropolitan Water District of Southern California," *American Political Science Review*, XXVI (1932), 695–97.

X. SMALLER WATER DISTRICTS

There are a number of water districts which are not as comprehensive in scope as those already mentioned but which do serve two or more municipalities. There are at least eight states which have general laws under which these governmental corporations for specific functions may be formed.[27] In addition, a number of small districts have been organized under special laws. A brief description of three of these smaller water districts follows.

The Mahoning Valley Sanitary District was formed under a general law[28] in 1926 to provide water of improved quality to the cities of Youngstown and Niles, Ohio. The District was created by the Court of Common Pleas of the county of Mahoning upon petition by the city councils and citizens of the two cities. Under the law, a director is appointed by the Court. He is given full power to construct and operate the water system, with the important exception that within incorporated places the distribution system is maintained by the local water departments. The District is financed by special assessments, water rates, and tax levies. The District is authorized to issue bonds. Under this authority the District has constructed a dam, an impounding reservoir, transmission mains, and a filtration and softening plant.[29]

One of the first small districts established under special legislation is the Kennebec Water District, created in 1899 to serve the city of Waterville, Fairfield village corpora-

[27] American Water Works Association, *Water Works Practice*, p. 556.

[28] Throckmorton, *Code of Ohio* (1929), sec. 6602—34–106.

[29] W. H. Dittoe, "The Water Supply Project of the Mahoning Valley Sanitary District," *Journal of the American Water Works Association*, XVIII (1927), 655–63.

tion, and the towns of Benton and Winslow, all in Maine.[30] The District is managed by five trustees, two of which are appointed by the municipal officials of Waterville, two by the municipal officials of Fairfield, and one by the county commissioners of Kennebec County. One of the most interesting provisions of the act requires that the rates be sufficient to pay, not only the costs of operation, but also the charges of interest and the sinking fund.

The Portland (Maine) Water District was established by the state legislature in 1907.[31] It maintains and operates the water system of Portland and 9 other municipalities at the present time. It is administered by a board of trustees of five members, four of whom are elected in Portland and one in South Portland. In the process of taking over the water supplies of the several municipalities in the District it has been necessary for it to purchase several private water companies. One of the results of this is that several different rates are in effect throughout the District. As in the Kennebec Water District, the water rates must cover maintenance, operation, interest, and sinking fund.[32]

XI. PRIVATE WATER COMPANIES

In many metropolitan areas some degree of co-ordination exists in the water supplies because of the presence of private water companies which supply more than one suburb. In the New York area 63 per cent of the communities are supplied by privately owned companies.[33] One of these, the Hackensack Water Company, serves 51 communities in Bergen and Hudson Counties, New Jersey.[34] In the Philadelphia region, the Philadelphia Subur-

[30] *Laws of Maine* (1899), chap. 200.

[31] *Ibid.* (1907), chap. 433.

[32] Cf. *Annual Reports of the Portland Water District.*

[33] Regional Survey, *op. cit.*, pp. 75 ff.

[34] *American City Magazine*, September, 1931, p. 7.

ban Water Company supplies 49 communities.[35] Ordinarily a private water company not only produces the water and transmits it to the communities but also distributes it to the individual consumers.

XII. CONCLUSION

While in the Chicago Metropolitan Region the many communities have been attempting to solve their water-supply problems without much co-operation, in other metropolitan areas the separate units have combined in some type of metropolitan organization in order to unify their action in handling the services which are of common interest to all sections. This unification of the water systems in other metropolitan areas not only contrasts with the disorganization in the Chicago Region but also suggests the directions which reorganization might take in the Chicago Area. In the other metropolitan areas, there are various types of organization, the result in part, we can assume, of the particular situation to which they were adapted. In any reconstruction of the governmental system for supplying water in the Chicago Region, the particular forms should be accommodated to the problems and circumstances of the Region. Nevertheless, the types of organization in other metropolitan areas not only indicate the desirability of reform in the Chicago Region but can be also adapted to the Chicago situation. Before indicating the form which the reorganization might take, it may be well to summarize the conclusions as to the existing organization in the Chicago Region and in other metropolitan areas.

[35] Regional Planning Federation of the Philadelphia Tri-State District, *The Regional Plan of the Philadelphia Tri-State District*, pp. 528–32.

CHAPTER VIII

SUMMARY OF CONCLUSIONS

1. The responsibility for supplying water in the Chicago Region is divided among 168 water systems, 208 governments, and 1,500 officials.

There is no unified organization for supplying water in the Region, but only a large number of water systems, governments, and groups of officials. Within Cook County alone there are 76 water systems, and in the entire Region there are 168. There are 89 municipal governments in Cook County and 204 in the Region which have the primary duty of providing water. In addition there are three states and the federal government which exercise some supervision over the various activities of the local units. Finally, there are about 700 officials of municipal governments and water systems in Cook County and 1,500 in the Region who are vested with the responsibility for supplying water.

Within the water systems there is a division of control which parallels the disorganization in the Region. There are two outstanding examples. One is the division of control in a majority of the water systems between the village or town boards which pump the water and the village or town clerks and collectors which have charge of reading meters, billing, collecting, and accounting; and the other is the divorcing of the laying of mains from the other water-supply activities in the municipalities of the Illinois section of the Region which have boards of local improvements. In the city of Chicago, the authority of the city

engineer, who is the real head of the water system, does not extend to the bureau of water, which is an important part of the water system.

Even the efforts to reduce the pollution of the Lake are distributed among a large number of municipalities and sanitary districts. The Sanitary District of Chicago has united the activities of many cities, towns, and villages in Cook County; but its work is made difficult by the existence of three small sanitary districts and a number of municipalities over which it has no control.

2. The greater part of the Chicago Region is a potential unity for the purpose of supplying water, from an engineering point of view.

Lake Michigan is the logical source of supply for a large part of the Region. Chicago is already supplying Lake water to 33 of its suburbs, and 3 other water systems are supplying 4 other villages which lie inland. In Cook County, 41 of the 89 municipalities and 3,789,919 (or 95.2 per cent) of the 3,982,123 people are supplied from Lake Michigan. Altogether, 53 of the 204 municipalities and 4,155,700 (or 85.5 per cent) of the 4,860,750 people in the Region receive water from the Lake. Many other communities are supplied inadequately with ground water or will be unable to develop abundant underground supplies within the next generation and should receive water from the inexhaustible Lake source.

The ground water of the Region is a common source for most of the communities, and its allocation is so interrelated with the allotment of Lake water that an equitable division of either can be made only by considering the needs of the Region as a whole.

Since the Lake is the most accessible place of disposal of the sewage and wastes of a considerable portion of the

Region, the problem of reducing the pollution of the Lake has become common to the majority of the communities and is almost as wide in territorial scope as the problem of supplying water itself.

There are certain sections of the Region which probably can always be supplied more economically with ground water than with Lake water, and there are communities which can dispose of their sewage without complicating the problem of reducing the pollution in the Lake; but the natural area for supplying water already includes a large part of the Region, and it may in the future encompass the Region in its entirety.

3. Effective co-operation among governments is lacking, with resulting inferiority of service and waste of funds.

This failure to co-operate appears, first of all, in the relationships between the governments. In some instances it takes the form of a simple inability to co-operate where mutual action is highly desirable. The suburbs west of Chicago have attempted to combine to lay transmission mains to Chicago without success. Nor would these suburbs and others contract with the Greater Chicago Lake Water Company and the Municipal Water Company, both of which proposed to supply numerous communities in the outlying sections of the Region. Indiana cities bordering the Lake and Illinois municipalities whose sewage drains into the Sanitary District of Chicago will not act together to prevent their sewage from polluting the Lake water supply.

Sometimes in the relationships between water systems, competition prevails rather than co-operation. The exploitation of the water resources in the Region has been competitive in nature, with no regard for the common interests of the many sections. This is particularly true in

the case of individuals and municipalities near the Lake which have appropriated ground water to the detriment of outlying areas.

Most common of all is a lack of consideration for the needs of others. Chicago does not provide mains at points on its boundary at which its suburbs can conveniently take water. Intervening municipalities do not construct their mains large enough to supply their neighbors. Chicago and other communities do not provide a special low rate to their satellites, although the provisions of the law establishing the Sanitary District of Chicago suggest that they do so. Chicago does not filter its water, but supplies its suburbs with water which is often turbid and excessive in disagreeable tastes and odors. Chicago meters only a small part of its consumption, and as a result it does not provide communities purchasing from it with sufficient pressure, and it charges more for its water than would be necessary if it reduced its waste to a minimum. Indiana cities turn their untreated sewage and wastes into Lake Michigan, polluting the water supply of Chicago and many of its suburbs.

In some cases the relationships between communities are characterized by active hostility. Thus, Oak Park demanded that Forest Park pay for easements and rights-of-way when the latter wished to lay a transmission main in Oak Park's streets; and, although it finally retreated from this position, Forest Park was delayed for several months. Blue Island and Dolton would not comply with the provisions of the Sanitary District law and supply water to Robbins and South Holland, respectively, until the latter secured judicial intervention. In the fixing of rates at which one water system sells to another, it is the custom of the vender to charge all that the traffic can stand.

The failure to co-operate also manifests itself in the in-

ability of the local governments to exchange experience and introduce generally the best methods in use in the Region. In each activity of water supply, one or more water systems is outstanding in the methods it has adopted; many water systems in at least one activity measure up to the best standards of scientific water-works operation. The ease of communication and the community of interests within the Region should facilitate the interchange of information on standard methods and the adoption of these methods. But corporate boundaries have operated as substantial barriers, and the great majority of the water systems are deficient in many or most of the activities.

The people of Chicago would only have to turn to Oak Park or almost any other water system in the Region to find the proof of the falsity of the arguments that have been advanced against universal metering; yet these arguments have prevailed. The benefits of municipal softening have been definitely disclosed in Hinsdale and Western Springs, but the great majority of the water systems in the Region continue to serve very hard ground water. Eleven of the water systems, including Kenilworth (with a population of 2,501), which have a Lake supply filter their water; Chicago and Gary, the two largest cities in the Region, as well as Hammond and Michigan City, do not filter but distribute water which is at times excessive in turbidity and disagreeable tastes and odors. In the financial aspects of operation, many water systems have introduced modern accounting methods and devised scientific rate schedules, but their experience has not been transmitted to the remainder of the Region. In almost every other activity of the water systems the same failure to exchange information on standard practices is found.

In some instances the introduction of the best proce-

dures is prevented by the smallness of the water system. Chicago and a number of other large communities are able to analyze their own water because they can afford to employ trained bacteriologists. Chicago can place its intakes farther from shore than any of its satellites; it can maintain an elaborate system of chlorination control; it can construct large and costly improvements out of current revenues—merely because of the large scale on which it operates. Only the existence of arbitrarily drawn boundary lines prevents the extension of these preferred practices to the remainder of the Region.

The failure to realize fully the possibilities of co-ordination of physical equipment is another type of lack of co-operation. Chicago is supplying water directly or indirectly to 33 of its suburbs. But 16 of the municipalities receiving water from it have their own pumping stations, and 15 have storage tanks. Eight transmission mains pass through cities or villages which are receiving water from Chicago. Within Oak Park lie the separate mains by which Forest Park secures its water from Chicago, and the transmission main by which Broadview and Westchester obtain their water from Chicago; Berwyn and River Forest receive Chicago water at points which are on the boundary of Oak Park. Twelve filtration plants serve 17 communities. Six (7, when Wilmette constructs its new plant) of these plants are serving 11 cities and villages which have a population of 125,236 and are concentrated in a compact area along the Lake shore north of Chicago. The largest, that of Evanston, is supplying a larger population than the other five combined. The only two water-softening plants in the Region are in contiguous villages.

The bureau of engineering of the city of Chicago has devised a plan by which it could serve all of the communities in Cook and Du Page counties and some of those in

Will and Lake (Illinois) counties. It is estimated that 12 pumping stations would serve the area not included in the city of Chicago, which would replace more than 80 pumping stations and an almost equal number of storage tanks now maintained by these communities. It has been ascertained that 3 filtration plants will be sufficient to serve the 3,688,882 people which Chicago supplies at the present time, or more than 1,000,000 people per plant. The many separate water systems have constructed and are maintaining an unnecessarily large amount of physical equipment.

Where some co-operation has been developed, it is rarely whole-hearted. Chicago supplies water to 33 suburbs, but every one of the latter distributes the water itself. When Broadview and Westchester combined to lay a main to Chicago, according to the village officials of Westchester, Broadview took advantage of its intermediary position to place the greater burden upon Westchester. If further evidence of the lack of co-operation in the Region is needed, one has only to point out that the sole instance in which complete unification of the water works of two or more communities has been achieved is the Home Water Company of Chesterton, which also pumps and distributes water in Porter. This was a private, and not a governmental, venture; and the combined population of the two towns is 3,036.

4. The fact that the water area lies in three states complicates the organization of water supply.

State supervision and control might be expected to bring some integration of the activities of the many water systems, and, in fact, it has done so to a limited extent. The bacteriological quality of the water has certainly been improved as the result of the efforts of the three states, and financial operations have been modernized in water sys-

tems over which the state authorities have jurisdiction. But on the whole, the existence of three states has served to increase the complexity of supervision and control.

In several activities three sets of standards prevail. In the bacterial analysis of water and in inspections for cross-connections, Indiana and Wisconsin have gone much farther than Illinois. The Indiana and Wisconsin public utility commissions are supervising the financial operations of both publicly and privately owned water systems, while the Illinois Commerce Commission has jurisdiction only over privately owned water companies. Illinois, on the other hand, has been much more active than Indiana and Wisconsin in encouraging the installation of municipal softening plants.

In other activities the states have given inadequate attention to Regional problems. The Illinois Division of Sanitary Engineering has been handicapped by lack of adequate power to order unsafe water supplies improved. In Indiana, the authority to issue water revenue bonds has been dribbled out by the legislature, and in some instances the Regional cities have been forced to demand special legislation. In Illinois, the Division of Sanitary Engineering is concentrating its efforts downstate, although there is an immediate need for supervision in many sections of the Region. Indiana has failed to give certain Regional cities the same authority to create sanitary districts which has been given to East Chicago, another city in the Indiana section of the Region.

To some of the more pressing problems of the Region, the state officials are giving no attention at all. Neither Illinois nor Indiana is exerting any effort to induce the co-operation which is so sorely needed among the water systems. Neither state is suggesting Lake Michigan as a possible source of abundant soft water. Although the fire

underwriters have discovered many deficiencies in the fire protection service of the various water systems, the state officials have done nothing to require the improvements which have been suggested.

Finally, in at least one instance there has been a definite display of hostility on the part of one state toward the interests of another. By exempting Lake Michigan from the act which outlawed the pollution of streams and lakes in Indiana, the Indiana legislature put itself on record as being unconcerned with the interests of the Chicago Region.

5. Long-time planning is almost impossible with the division of responsibility which exists in the Region.

If there were any prospect for a plan in the future to develop a Regional water system which would conform to the natural physical unity for the purpose of supplying water, the failure of the water systems to co-operate and the complicating effects of the three states might be disregarded. Unfortunately, the division of responsibility in the Region has militated against the development of such a plan. With the present disorganization there seems to be no hope for an allocation of the water resources except in accordance with the competitive method that is in use now. The provisions of the Sanitary District law contain the only method for transmitting water to inland communities, and the possibility under these provisions of carrying water out into the Region much farther than it is taken now seems small. The Sanitary District law includes also the principle of apportioning the costs of supplying water which is followed in most cases. Until some other principle is found, and there has been no attempt to devise one, the equitable division of costs is impossible. There have been several plans in the past, and the city of Chicago is working out a plan now to supply a large part of the Illinois section of the Region from the Lake. But such plans are like

houses of cards unless they are the product of the desires of the communities to which they apply, and the latter are showing no inclination to interest themselves in such plans. While the desirability of a co-ordinated plan for pumping stations, storage tanks, treatment plants, mains, and other physical equipment seems obvious, the emergence of such a plan from the present disorganized water systems seems almost hopeless.

6. A comparison with the water organization in other metropolitan areas emphasizes the disorganization in the Chicago Region and suggests possibilities of reconstruction.

In sharp contrast with the lack of co-ordination in the Chicago Region is the unification which has been achieved in other metropolitan areas. In these other regions, several types of organization have been adopted to integrate the water supply activities of the separate communities.

Interstate agreements have been the basis of co-operation in two cases. The states of Kansas and Missouri have, for the benefit of the Kansas City metropolitan area, provided for exemption from taxation of water-works property which is located in the neighboring state and for the mutual exercise of the right of eminent domain. New York, New Jersey, and Pennsylvania have negotiated a compact for the division of the waters of the Delaware River; and if it is ratified, the New York region will be the chief beneficiary of the definitive settlement of the rights to the waters.

State action has been taken in some instances. Thus, both the state of New York and the state of New Jersey have assumed control of the apportionment of the available water resources within the respective states, largely to protect the interests of the New York metropolitan area. In the Boston region the Massachusetts Metropolitan District Commission, a state-controlled agency, has devel-

oped water sources and is wholesaling water to the city of Boston and a number of its suburbs.

The county is the unit for integration in some metropolitan areas. County metropolitan districts in the Baltimore region and county sanitary engineering departments in the Cleveland and Cincinnati regions are providing water systems for the suburban populations. In the Detroit region, it is the central city which has gradually assumed the responsibility for developing a metropolitan water supply. The central cities have also taken some of the responsibility for the development of the larger water systems in the Baltimore, Cleveland, and Cincinnati regions.

Water districts which include a number of suburbs have been formed in the Washington, San Francisco–Oakland, Los Angeles, Portland (Maine), and other metropolitan areas. In the Los Angeles region, the district is wholesaling the water to the separate units; but in the Washington, San Francisco–Oakland, and Portland regions the districts are distributing the water directly to the consumers. Finally, private water companies have consolidated the water systems of clusters of communities.

In the Chicago Region, the Sanitary District of Chicago has unified the efforts of some 61 communities to prevent their sewage from polluting the Lake Michigan water supply. Almost nothing has been done to co-ordinate other water-supply activities, and Chicago lags far behind other urban centers in co-operative endeavor. The prototypes for an integrated organization in these other metropolitan areas should be of value in considering the methods of reconstruction in the Chicago Region. The conclusions of this investigation point directly to the necessity of reorganization, and it is to the possible alternative forms of this rehabilitation that we now turn.

CHAPTER IX

SOME ALTERNATIVES FOR REORGANIZATION

From an examination of the existing organization of the water-supply systems of the Region, there emerge some suggestions for reconstruction. The cursory review of the methods for meeting metropolitan water-supply problems elsewhere offers some additional ideas for reform. Several alternatives are given, with the hope that they may stimulate discussion and thought on the subject and eventually lead to some form of action which may or may not be in accordance with these suggestions.

1. Voluntary co-operation between governments might be given a further trial.

It was our conclusion that the possibilities of co-operation among water systems had not been fully realized. While the very existence of local autonomy may make co-operation impossible, it may well be that it simply has not been given adequate consideration. The proposal of new and different forms of mutual action may find a more responsive reception.

Co-operation might take the form of the employment of common officials by several communities. One water superintendent might be placed in charge of several small systems. This would make possible the selection of an individual who is an expert in water-works matters, where the small communities acting separately could pay only for men who have no technical training. One trained sanitary engineer might serve a group of communities. In fact, such

arrangements are already in existence. The chemist of the Sanitary District of Chicago is also chemist for the North Shore Sanitary District. The superintendent of the water system of Springfield, Illinois, is acting as a consultant at Bloomington. The officials and employees of water departments in a group of contiguous municipalities might be consolidated to permit a division of labor which does not now exist. Where certain large communities are serving smaller communities with water—for example, Winnetka, which is supplying Northfield; Glencoe, which is supplying Northbrook; and Highland Park, which is supplying Deerfield and Highwood—the water superintendent of the former might be appointed water superintendent in the latter and assume the functions which are now exercised by local employees in the smaller communities with some increase in efficiency and reduction in expense.

Another type of co-operation might be the formation of associations of officials which could hold meetings regularly and discuss their common problems. The West Shore Water Producers Association is a good example of such an association. Its membership is drawn from the communities bordering the Lake in Illinois and Wisconsin which have filtration plants; it holds monthly meetings. The American Water Works Association, with its annual meeting and its annual sectional conferences, is another example. At the present time only a few of the officials in the Region are members of the Association. It might be possible to extend the membership of these associations or of others similar to them to a larger number of the waterworks officials in the Region. These associations would include only technicians. Similar organizations might be formed of policy-determining officials. The recently organized Cook County Suburban League, an association

largely of suburban mayors, could very well discuss the common water-supply problems of the municipalities represented and devise policies for their solution.

Further efforts might be made to co-ordinate the physical equipment of the water systems. Adjoining communities might be able to make some arrangement to combine pumping stations, transmission mains, or treatment plants. Particularly among the communities which are getting their water from Chicago would this seem to offer possibilities of ready execution. The contiguity of so many sets of municipalities in the Region should facilitate arrangements to reduce the unnecessary physical equipment in the Region.

2. Joint water districts which would include several municipalities might be created.

This alternative is suggested with considerable hesitation because there are undoubtedly too many governments in the Region already. Its only justification is the obvious need for reducing the number of water systems, and it should be adopted only if all other methods of unification fail. The one mitigating factor is that such districts would not have to be tax-levying bodies and no additional burden would have to be placed upon the electorate. All expenses of the district could be met from water revenue bonds and from water rates. A water superintendent could be chosen by joint action of the municipal executives or legislative bodies, and he could have complete charge of the affairs of the district. The few matters of policy, such as the basic principles for handling the existing water-works property and water-works debt, could be set forth in the instrument creating the district. There would still be the problem of securing co-operation between districts, but it would probably be simpler for a few large districts to co-ordinate their

activities than it is for a large number of small water systems to do so. Eventually, considerable integration of the water systems in the Region might be achieved.

State legislation has already anticipated the formation of joint water districts in Illinois and Wisconsin. A law of 1879 in Illinois provides that adjacent municipalities may unite to supply water, without specifying in detail how this shall be done.[1] A law of 1899 permits adjacent communities to form a water district, to be governed by a board of trustees composed of the joint city councils or village boards.[2] A more recent law of 1911, applying only to counties bordering Lake Michigan, authorizes the creation of water districts which are to be governed by five trustees elected from divisions of the water districts.[3] The Wisconsin laws provide for the establishment of municipal water districts. They are to be governed by five directors, who are chosen by the chief executives of the municipalities within the districts.[4] Considerable progress toward consolidation of the water systems in the Region might be made under these laws, though some modifications would probably be desirable and the obvious gap in Indiana would have to be filled. However, this legislative action illustrates the legal recognition of the principle of co-ordination of the water systems, and it might be further developed.

3. Chicago might be given greater power and responsibility in supplying water to its suburbs.

Since Chicago is already supplying directly or indirectly a great many of the communities in the Region, it is in a position to assume much of the responsibility for co-ordi-

[1] *Laws of Illinois* (1879), p. 63. [2] *Laws of Illinois* (1899), pp. 108–10.

[3] *Laws of Illinois* (1911), pp. 190–98.

[4] *Wisconsin Statutes* (1931), sec. 198.01–21.

nating water-supply activities. Its present obligation to supply water at its limits to any city, town, or village within the Sanitary District, and its power to collect for this service might be extended. The city could be given the authority to examine and approve plans for extensions and improvements in any suburbs which obtain water directly or indirectly from it. Such power, which is exercised by the city of Detroit with respect to its satellites, gives the metropolis the opportunity of devising a master-plan for the Region and requiring conformance to it. Chicago might further be empowered to act as an arbitrator as to rates when disputes arise between two communities which are supplied by Chicago. Its jurisdiction might extend even to supervising the activities of local water departments. (Detroit also does this.) Finally, Chicago might be given the authority to operate and maintain water systems of communities which it serves, at the request of the latter.

While some of these things might be accomplished by co-operation, legislation would be necessary to achieve most of them. Some modification of the present provisions of the law seems almost necessary, however, if it is to be applicable to present conditions. When the section compelling municipalities with Lake supplies to provide their neighbors with water was inserted in the Sanitary District law in 1889, most of the communities in the District were adjacent to Chicago; now, there are a number of municipalities in the outlying areas of the District. It was the original intention of the framers of this provision to compensate the suburbs for their aid in disposing of Chicago's sewage by securing to them a supply of Lake water. If this object is to be carried out at the present time, there must be some central control in order that the outlying communities can secure Lake water.

4. The Sanitary District of Chicago might be given the additional authority of developing a metropolitan water system.

Because of the rather dubitable reputation of the Sanitary District, this alternative may at first thought be considered unworthy of attention. It has in its favor, however, certain distinct advantages. The difficulties of the District have arisen largely because its work is so inconspicuous, in comparison with other governments in Cook County, that the voters have not taken the trouble to watch it; and it might well be that it would attract more public attention if it were given some additional power. The territorial jurisdiction of the District is already commensurate with the more immediate water-supply problems in the Region; and if its boundaries are extended to cover the natural area of sewage disposal, it will include even the sections of the Region in which the need for integration is less urgent. The Sanitary District has an elaborate engineering staff, many of the members of which might well fit into a water-supply organization. If the Sanitary District were to assume the responsibility for coordinating the water systems within the District, it might not only have a salutary effect upon this agency, but would also probably result in an improvement of the water-supply service.

If we look into the future, the Sanitary District will probably be absorbed by some other agency in the Region. Since it only confuses the control of an already overcomplex governmental system, it is highly improbable that it will continue with its present powers and jurisdiction. It may well be that ultimately its functions will be exercised by some agency representing the entire Region or a portion of the Region. But the logic of events will very likely bring the activities of water supply under the control of the

same authority, since the water supply problem is also Regional in character. The starting-point to the final result might well be the assumption of the control of water-supply affairs by the Sanitary District.

5. Cook County might be empowered to co-ordinate the water systems of the suburbs within its jurisdiction.

Since the more pressing problems, as well as the greater possibilities for savings, exist in the Cook County section of the Region, the county government might be given authority to deal with suburban problems.

One proposal for unification of the water systems in Cook County, by Griffenhagen and Associates, would transfer all water-supply systems of the government units in the county to a Bureau of Water Supply of a Metropolitan Public Works Administration. This is part of a larger plan to turn over a number of functions now carried on by the local units to the county government. The very serious objection has been made to this scheme that it would set up "two powerful and competing governments, Chicago and Cook County, ... [which] might create diffusion and rivalry of authority rather than smoothness of governmental operation."[5]

Perhaps it would be possible, however, to create a bureau in the county government which would have power to co-ordinate the water systems of the suburbs. Such a bureau could, in co-operation with the Chicago water department, devise a plan by which Chicago would supply all of the suburbs desiring Lake water. It could provide the necessary mains, pumping stations, and storage tanks and apportion the cost for these structures among the communities served. In the Cleveland, Cincinnati, and Baltimore

[5] Merriam, Parratt, and Lepawsky, *The Government of the Metropolitan Region of Chicago*, p. 152.

metropolitan areas, county sanitary engineering departments are constructing water systems for suburban areas. While the county might maintain the water systems also, it would probably be more desirable to permit the individual municipalities or the city of Chicago to perform this activity.

This plan would have at least two advantages over the scheme of giving Chicago greater power. Communities which would resent control by Chicago might co-operate with the county government. The county government might be able both to induce co-operation among the suburbs and to co-operate more easily with the city of Chicago.

6. The state governments might exercise more control.

State supervision might be extended in certain activities to the benefit of the water-consumers in the Region. Since this study has shown that the control which the public utility commissions of Wisconsin and Indiana have exercised over the financial affairs of the water systems has resulted in indubitable improvement, the Illinois Commerce Commission might be given similar authority with respect to the municipally owned systems in the Illinois section of the Region. The Illinois Bureau of Sanitary Engineering might also profitably be authorized to exercise more extensive supervision over the safety of water supplies. The State Board of Health of Indiana should have more power to prevent the pollution of Lake Michigan by the cities in the Calumet Region.

Another point at which state action would be very desirable is in the allocation of water resources. This is a problem which could be dealt with on a Regional basis much more adequately than it is now, but which in reality encompasses an area much larger than the Region. Since

the ground-water resources of the Region are common not only to the communities in the Region but also to a number of people outside the Region, state intervention seems almost necessary to protect the interests of all parties.

In submitting this alternative, let us emphasize again our conclusion that the states have not shown the ability to cope with Regional problems. We have not suggested that a state agency be authorized to co-ordinate the water systems of the Illinois section of the Region, because we do not believe that a state agency is capable of doing this. Greater state supervision could undoubtedly improve the service at various points, but an effective co-ordination of the water systems of the Region will have to come from within the area itself.

7. Interstate action might be taken to solve problems which are common to two or three states.

One of the most pressing problems in the Region is the discharge of sewage and wastes into Chicago's water supply by Indiana cities and industries. This is an interstate problem, and it would seem obvious that the proper authority to work out the solution would be some agency created by interstate compact. This form of interstate cooperation is mentioned in the national constitution, and has been employed in a number of instances. The Kansas City metropolitan area, it was indicated earlier in this study, benefits from an agreement between Kansas and Missouri, which provides for mutual privileges of water works in the two states. Interstate compacts have been even more important in other fields. The most powerful body yet created in this way is the Port of New York Authority, whose accomplishments compare favorably with those of many states. Established in 1921 by the states of New York and New Jersey with the power originally to

purchase, construct, lease, and operate any terminal or transportation facility in the district, its authority has been extended to cover many other matters.[6]

Within the Region has come a proposal to create an Interstate Port District of Illinois and Indiana governed by an Interstate Port Authority. The jurisdiction of this district might be enlarged to comprehend a number of other activities which are interstate in character, including sewage disposal. To this district could be transferred the functions now performed by the Sanitary District of Chicago and the smaller sanitary districts in the Region, as well as the responsibility for preventing the pollution of Lake Michigan by sewage and wastes from the cities in the Indiana section of the Region. The problem of reducing the pollution of the Lake is just as urgent, and the desirability of co-ordination is just as great, as the necessity for unity of port facilities; and interstate action offers the same opportunities for co-operation in both fields. The district might also be delegated to integrate the water-supply systems on the two sides of the state boundary. Hammond, Indiana, already supplies water to a few consumers in Calumet City, Illinois; and this exchange of facilities might well be further developed.

8. Complete unification might be achieved through a metropolitan government.

In other studies in the series of which this is a part, the desirability of a government which is metropolitan in territorial jurisdiction and which would be vested with power in a number of fields where the problems are no longer local in nature has been emphasized. If such a government were

[6] For a more extended discussion of the Port of New York Authority, see *ibid.*, pp. 162–63.

created, the advisability of its having complete control of the functions of supplying water seems beyond question.

Such a metropolitan government might be limited to Cook County or to the Illinois section of the Region or, preferably, it might encompass the entire Region. It might be a super-government, to which existing local governments would surrender much of their authority; or it might be a separate state which would have complete power to reorganize the administrative and governmental units of the Region. It might be an interstate authority established by interstate compact.

That effective co-ordination of water supply efforts can be accomplished only through unification of the water systems of the Region or a large share of the Region is beyond dispute. Through unification it would be possible to divide the common water resources of the Region to the best advantage of all the people. The water works could be designed according to engineering requirements, unaffected by legal barriers in the form of city, town, village, and state boundaries. The standards which have been attained by only a few water systems in the Region could be extended to all of the water-supply activities. Planning would go ahead on a Regional basis, with the interests of all sections considered. Unified administration, division of labor, technically trained officials and employees, would characterize the personnel. More abundant quantities of water, improved quality, better service, and reduction in costs would be the almost certain result of unification of the water systems of the Region.

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APPENDIX

LIST OF MUNICIPALITIES, WITH LEGAL STATUS, POPULATION, SOURCE OF WATER SUPPLY, AND WATER RATES

Name	City, Town, or Village	Population	Source of Water Supply	Rates per 1,000 Gallons*	
				Maximum Domestic	Minimum Industrial
Illinois					
—Cook County					
Alsip	Village	327	None		
Arlington Heights	Village	4,997	Ground water	....	...†
Barrington	Village	3,213	Ground water	$0.30	$0.12
Bartlett	Village	504	Ground water	.54	.14
Bellwood‡	Village	4,991	Ground water	.27	.27
Berkeley	Village	779	Ground water	....	....
Berwyn	City	47,027	Chicago	.22	.20
Blue Island	City	16,534	Chicago	.19	.09
Broadview	Village	2,334	Chicago	.40	.40
Brookfield	Village	10,035	Ground water	.46	.18
Burnham	Village	994	Chicago	....	....
Calumet City	City	12,298	Chicago	.25	.15
Calumet Park	Village	1,429	Chicago	....	....
Chicago	City	3,376,438	Lake Michigan	.07	.07
Chicago Heights	City	22,321	Ground water	.49	.10
Chicago Ridge	Village	269	None		
Cicero	Town	66,602	Chicago	.13	.13
Crestwood	Village		None		
Des Plaines‡	City	8,798	Ground water	.40	.20
Dixmoor	Village	944	Harvey	.36	.29
Dolton	Village	2,293	Chicago	.24	.24
East Hazel Crest	Village	686	None		
Elmwood Park	Village	11,270	Chicago	.12	.12
Evanston	City	63,338	Lake Michigan	.16	.09
Evergreen Park	Village	1,594	Chicago	.27	.13
Flossmoor	Village	808	Ground water	....	....

* Discounts for prompt payment have been deducted in computing these rates.

† Where no water rates are shown, the information is lacking or, in a few instances, the municipality charges a flat rate instead of a meter rate.

‡ Purchases water from private parties.

Name	City, Town, or Village	Population	Source of Water Supply	Rates per 1,000 Gallons	
				Maximum Domestic	Minimum Industrial
Illinois —Cook County—Cont.					
Forest Park	Village	14,555	Chicago	$0.36	$0.22
Forest View	Village	125	Stickney	.22	.20
Franklin Park	Village	2,425	Ground water	.35	.16
Glencoe	Village	6,295	Lake Michigan	.31	.31
Glenview	Village	1,886	Ground water	.43	.18
Glenwood	Village	603	None		
Golf	Village	112	Ground water	....	....
Harvey	City	16,374	Chicago	.29	.19
Hazel Crest	Village	1,162	Harvey	.35	.35
Hillside	Village	1,004	Ground water	.48	.19
Hodkins	Village	302	None		
Homewood	Village	3,227	Ground water	.27	.18
Justice	Village	377	None		
Kenilworth	Village	2,501	Lake Michigan	.30	.25
La Grange§	Village	10,103	Ground water	.35	.17
La Grange Park‡	Village	2,939	La Grange	.40	.40
Lansing	Village	3,378	Ground water	.21	.12
Lemont	Village	2,582	Ground water	....	....
Lyons	Village	4,787	Ground water	.50	.14
McCook	Village	367	None		
Markham	Village	349	Harvey	.35	.35
Matteson	Village	736	Ground water	....	....
Maywood	Village	25,829	Ground water	.22	.14
Melrose Park	Village	10,741	Ground water	.27	.14
Midlothian	Village	1,775	None		
Morton Grove	Village	1,974	Chicago	.60	.30
Mount Prospect	Village	1,225	Ground water	.40	.20
Niles	Village	2,135	Chicago	.25	.14
Niles Center	Village	5,007	Chicago	.19	.13
Northbrook	Village	1,193	Glencoe	.32	.27
Northfield	Village	311	Winnetka	....	....
North Riverside	Village	969	Berwyn	.24	.19
Oak Lawn	Village	2,045	Ground water	.40	.36
Oak Park	Village	63,982	Chicago	.20	.15
Olympia Fields	Village	143	Ground water	....	....
Orland Park	Village	571	Ground water	....	....

‡ Purchases water from private parties.
§ Privately owned.

Name	City, Town, or Village	Population	Source of Water Supply	Rates per 1,000 Gallons	
				Maximum Domestic	Minimum Industrial
Illinois					
—Cook County—Cont.					
Palatine	Village	2,118	Ground water	$0.36	$0.40
Palos Park	Village	456	None		
Park Ridge	City	10,417	Chicago	.27	.18
Phoenix	Village	3,033	Harvey	....	....
Posen	Village	1,329	Harvey	.36	.29
Richton Park	Village	137	None		
Riverdale	Village	2,504	Chicago	.14	.11
River Forest	Village	8,829	Chicago	.27	.18
River Grove	Village	2,741	Chicago	.35	.09
Riverside	Village	6,770	Ground water	.30	.28
Robbins	Village	753	Blue Island	....	....
Schiller Park	Village	709	Ground water	.20	.12
South Chicago Heights	Village	1,691	Ground water	.25	.25
South Holland	Village	1,873	Dolton	.50	.50
Spring Forest	Village	733	None		
Steger	Village	2,985	Ground water	.30	.30
Stickney	Village	2,005	Chicago	.22	.11
Summit	Village	6,548	Chicago	.48	.28
Tessville	Village	473	Chicago	.25	.20
Thornton	Village	1,012	Ground water	.30	.26
Tinley Park	Village	823	Ground water	.25	.20
Westchester	Village	358	Chicago	.35	.35
Western Springs	Village	3,894	Ground water	.75	.35
Wheeling	Village	467	Ground water	.25	.12
Wilmette	Village	15,233	Evanston	.29	.18
Winnetka	Village	12,166	Lake Michigan	.20	.20
Worth	Village	411	None		
—Du Page County					
Addison	Village	916	Ground water	....	....
Bensenville	Village	1,680	Ground water	.35	.35
Bloomingdale	Village	337	None		
Clarendon Hills§	Village	933	Ground water	.36	.27
Downers Grove	Village	8,977	Ground water	.45	.18
Elmhurst	City	14,055	Ground water	.29	.19
Glen Ellyn	Village	7,680	Ground water	.25	.25
Hinsdale	Village	6,923	Ground water	.43	.18
Itasca	Village	594	Ground water	....	....

§ Privately owned.

Name	City, Town, or Village	Population	Source of Water Supply	Rates per 1,000 Gallons	
				Maximum Domestic	Minimum Industrial
—*Du Page County —Continued*					
Lombard	Village	6,197	Ground water	$0.30	$0.30
Naperville	City	5,118	Ground water	.27	.16
Roselle	Village	807	Ground water	.40	.15
Villa Park	Village	6,220	Ground water	.32	.27
West Chicago	City	3,477	Ground water	.41	.15
Westmont‡	Village	2,733	Ground water	.45	.32
Wheaton	City	7,258	Ground water	.24	.24
Winfield	Village	445	Ground water	.39	.15
Wood Dale	Village	230	None		
—*Lake County*					
Antioch	Village	1,101	Ground water	....	....
Bannockburn	Village	186	None		
Deerfield	Village	1,852	Highland Park	.47	.47
Fox Lake	Village	880	Ground water	.30	.10
Grays Lake	Village	1,120	Ground water	.....	....
Gurnee	Village	503	None		
Hainesville	Village	81	None		
Highland Park	City	12,203	Lake Michigan	.27	.20
Highwood	City	3,590	Highland Park	.32	.32
Lake Bluff	Village	1,452	Ground water	.36	.23
Lake Forest	City	6,554	Lake Michigan	.20	.20
Lake Villa	Village	487	None		
Lake Zurich	Village	368	Ground water	....	....
Libertyville	Village	3,791	Ground water	.32	.18
Mundelein	Village	1,011	Ground water	.30	.18
North Chicago	City	8,466	Ground water	.35	.19
Round Lake	Village	338	Ground water	.27	.14
Wauconda	Village	554	Ground water	....	....
Waukegan	City	33,499	Lake Michigan	.35	.09
Winthrop Harbor	Village	661	Ground water	.22	.20
Zion	City	5,991	Ground water	.30	.18
—*Will County*					
Beecher	Village	772	Ground water	....	....
Crete	Village	1,429	Ground water	....	....
Elwood	Village	257	None		
Frankfort	Village	590	Ground water	....	....
Joliet	City	42,993	Ground water	.60	.30

‡ Purchases water from private parties.

Name	City, Town, or Village	Population	Source of Water Supply	Rates per 1,000 Gallons	
				Maximum Domestic	Minimum Industrial
—*Will County—Cont.*					
Lockport	City	3,383	Ground water	$0.63	$0.54
Manhattan	Village	628	Ground water	....	....
Mokena	Village	562	Ground water	....	....
Monee	Village	383	Ground water	.40	.40
Peotone	Village	1,154	Ground water	.30	.20
Plainfield	Village	1,428	Ground water	1.09	.19
Roekdale	Village	1,701	Ground water	.36	.36
Romeoville	Village	133	None		
Symerton	Village	77	None		
Wilmington	City	1,741	Ground water	.30	.20
—*McHenry County*					
Algonquin	Village	866	Ground water	....	....
Cary	Village	731	Ground water	....	....
Crystal Lake	Village	3,732	Ground water	.40	.40
Fox River Grove	Village	641	Ground water	....	....
Huntley	Village	670	Ground water	....	....
McHenry	City	1,354	Ground water	....	....
Spring Grove	Village	184	None		
—*Kane County*					
Aurora	City	46,589	Ground water	.72	.10
Batavia	City	5,045	Ground water	.83	.13
Burlington	Village	224	None		
Carpentersville	Village	1,461	Ground water	.10	.10
East Dundee	Village	1,341	Ground water	.20	.15
Elburn	Village	548	Ground water	....	....
Elgin	City	35,929	Ground water	.27	.09
Geneva	City	4,607	Ground water	.47	.20
Gilberts	Village	130	None		
Hampshire	Village	656	Ground water	....	....
Maple Park	Village	389	Ground water	....	....
Montgomery	Village	546	Ground water	....	....
North Aurora‡	Village	682	Ground water	.45	.45
Pingree Grove	Village	125	None		
St. Charles	City	5,377	Ground water	.68	.20
South Elgin	Village	745	None		
West Dundee	Village	1,697	Ground water	.15	.10
—*Kendall County*					
Bristol	Village	377	None		
Oswego	Village	932	Ground water	....	....
Plano	City	1,785	Ground water	....	....
Yorkville	Village	492	Ground water	....	....

‡ Purchases water from private parties.

Name	City, Town, or Village	Population	Source of Water Supply	Rates per 1,000 Gallons	
				Maximum Domestic	Minimum Industrial
—*Grundy County*					
Minooka	Village	346	Ground water	$0.30	$0.30
—*Kankakee County*					
Grant Park	Village	508	Ground water	....	....
Manteno	Village	1,149	Ground water	....	....
Momence	City	2,236	Ground water	.40	.10
Indiana					
—*Lake County*					
Crown Point	City	4,046	Ground water	....	....
Dyer	Town	672	Ground water	.25	.08
East Chicago	City	54,784	Lake Michigan	.28	.06
East Gary	Town	2,409	None		
Gary§	City	100,426	Lake Michigan	.23	.05
Griffith	Town	1,176	Ground water	....	....
Hammond	City	64,560	Lake Michigan	.10	.04
Highland	Town	1,553	Ground water	.50	.20
Hobart§	City	5,787	Lake George	.25	.10
Lowell	Town	1,274	Ground water	....	....
Munster	Town	975	Ground water	.45	.20
New Chicago	Town	481	None		
St. John	Town	332	None		
Schererville	Town	580	Ground water	....	....
Schneider	Town	264	Ground water	....	....
Whiting	City	10,880	Lake Michigan	....	....
—*La Porte County*					
La Porte	City	15,755	Ground water	.10	.04
Long Beach§	Town	436	Lake Michigan	....	....
Michigan City	City	26,735	Lake Michigan	.10	.05
Trail Creek	Town	295	None		
Westville	Town	496	Ground water	.40	.25
—*Porter County*					
Chesterton§	Town	2,231	Ground water	.17	.10
Dune Acres	Town	12	None		
Hebron	Town	693	Ground water	.25	.20
Kouts	Town	583	None		
Ogden Dunes	Town	50	None		
Porter§	Town	805	Ground water	.17	.10
Valparaiso	City	8,079	Lakes	.27	.11
Wisconsin					
—*Kenosha County*					
Kenosha	City	50,262	Lake Michigan	.20	.06

§ Privately owned.

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